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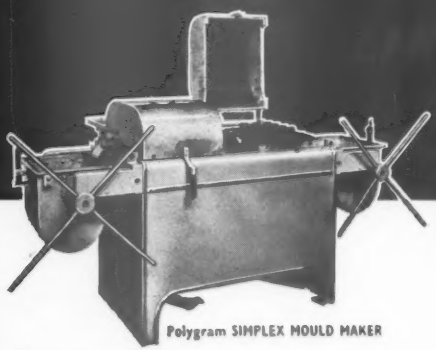

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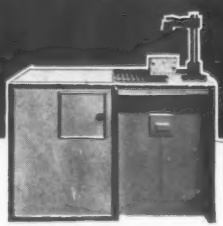

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Thoughts for 1956

He would be a brave man who would dare to prophesy the trend of business in the foundry industry in 1956. On the credit side, most firms start the year with full order books. Those firms servicing the shipbuilding industry should be well placed, as record bookings for new ships have been announced. Many other sections of the industry are similarly situated, yet there is one—that devoted to the manufacture of domestic cooking and heating appliances—which is frankly worried. Here, the impact of the "credit squeeze" is having a banal influence on production. We have no pretensions to a profound knowledge of economics, but we well remember how the abuse of the deferred-payment system caused the dreadful slump in America in 1929 and 1930. No doubt the Government must have had this well in mind when launching its present policy.

Also on the debit side, is the present claim for a 15 per cent. or £200 million increase in wages by the trade unions within the engineering industry. There is a misconception amongst many operatives that this money will come out of the pockets of the "capitalists," whereas in truth what actually happens is that announcements will be made that "owing to the recent wages award all prices as from to-day's date will be increased by *x* per cent." The customer winces on receiving such a demand, and then promptly writes a similar note to his clients, until finally it is the "man in the street" throughout the country—and abroad—who actually pays the increase. It may be, however, that if driven too far these nebulous individuals may defer ordering or stop buying. Then a slump sets in, or perhaps to avoid this more banknotes are printed and the consumer gets less and less for his pound.

The remedy for such pernicious effects is unquestionably higher productivity and, although comparisons are difficult, it does seem (and statistics support this claim), that the foundry industry is amongst those leading in the promotion of manufacturing efficiency. The exchange of technical information is alike extensive and efficient and has animated even some of the smallest concerns with almost startling results. An upward revision of wages does not impair the competitive power of the individual concern, for they are all in the "same boat" so far as the home market is concerned. However, where exports are concerned—and the foundry industry is involved in this market more than it realizes—the way to win through is by ever-increasing manufacturing efficiency. To quote the Rt. Hon. Reginald Maudling, the Minister of Supply: "In 1955 there has been a rapid and even dramatic increase in the rate of construction of new factories, plant and machinery. This is a most welcome development because on this, and on this alone, the prospects for our standard of living in the future depend."

SIR GEORGE BARNETT
H.M. Chief Inspector of Factories

Featuring . . . .

SIR GEORGE BARNETT

AS Her Majesty's Chief Inspector of Factories, Sir George Barnett in recent years has taken a personal interest in the foundry industry. This interest has been productive of much good as during the last seven years, despite the growth of the foundry industry, accidents have been reduced by over 25 per cent. This year, he has participated in two foundry conferences on foundry ventilation and dust elimination, whilst last year he presented an inspiring paper at the Safety Conference organized by the Council of Ironfoundry Associations.

Sir George was educated at Peter Symonds School, Winchester, and at the University College, Southampton. From here, he went straight into the army and served as a lieutenant in the 15th London Regiment. In 1920, he entered the Factory Department, then part of the Home Office. There is no short cut from the bottom to the top of a Government Department, and Sir George passed through all the stages, first as junior inspector at Liverpool until 1923, then as divisional inspector in London, being promoted to district inspector in Rotherham and later in the Preston and South Essex districts. By 1941, he was superintending inspector at Manchester; by 1944, Deputy Chief Inspector of Factories and, in 1947, he received his appointment as Chief Inspector. For his services he was knighted in 1952.

It is noteworthy that extended reference is always made by Sir George in his annual reports to accidents to youth; this is an indication of his personal character, that is, not to regard accidents from the economic angle but from the truly humane aspect. In the course of his professional activities, he is called upon to preside over a large number of committees devoted to accident prevention. Amongst the bodies in which he takes great interest is the Royal Society for the Prevention of Accidents of which organization he is vice-president.

As a relaxation Sir George does some gardening—he thinks he might become a good gardener, if only he had sufficient time. He also likes walking and travel.

New Year Honours

A number of people associated with the foundry, iron and steel, and allied industries received awards in the New Year Honours List announced last weekend. Details of some of the awards are given below:

BARONS

SIR (FRANCIS) RAYMOND EVERSHED, who has been Master of the Rolls since 1949. He has also served as a member of the Industrial and Export Council appointed by the President of the Board of Trade. He was chairman of committees of inquiry into dock wages in 1945, and into prices and production of textile machinery, 1946.

SIR FREDERICK GODBER, chairman of the Shell Transport & Trading Company, Limited, and the Shell Petroleum Company, Limited. He is chairman of several other companies, including the Commonwealth Development Finance Company, Limited.

BARONETS

COL. JAMES RILEY HOLT HUTCHISON, who was MP for the Glasgow Central Division from 1945 to 1950 and has sat for the Scotstoun Division of Glasgow since October, 1950, for political and public services. He was Parliamentary Under-Secretary of State and Financial Secretary at the War Office from 1951 to 1954. Col. Hutchison was vice-president of the Associated British Chambers of Commerce from 1950 to 1951. He was appointed Parliamentary chairman of the Dock and Harbour Authorities Association in 1951.

COL. CHARLES EDWARD PONSONBY, MP for Sevenoaks from 1935 to 1950, for political and public services. Colonel Ponsonby was Parliamentary Private Secretary to the Secretary of State for War and Secretary of State for Foreign Affairs from 1940 to 1945 and was a member of Parliamentary delegations to Russia, Austria, and Burma. A director of Standard Telephones & Cables, Limited, in 1950 he was a member of an industrial relations mission to Nigeria.

KNIGHTS BACHELOR

MAJOR ARTHUR HAROLD BIBBY, senior partner of Bibby Bros. & Company, shipowners, of Liverpool. He is a member of the Mersey Docks and Harbour Board and a past-chairman of Liverpool Steamship Owners' Association.

MR. CHARLES CONNELL, chairman of the Glasgow shipbuilding concern of Charles Connell & Company, Limited, and a director of Scottish Ore Companies, Limited, and other companies. In 1954 he was elected president of the British Employers' Confederation and of the British Shipbuilding Research Association. Mr. Connell has also served as a part-time member of the Iron and Steel Board, and his directorships have included those of the Iron Trades Employers' Insurance Association, Limited, and the Iron Trades Mutual Insurance Company, Limited.

MR. WILLIAM LYONS, chairman and managing director of Jaguar Cars, Limited, Coventry. Mr. Lyons is vice-president of the Society of Motor Manufacturers and Traders.

ORDER OF THE BATH

GCB

SIR HAROLD CORTI EMMERSON, Permanent Secretary to the Ministry of Works and Permanent Secretary designate to the Ministry of Labour and National Service. Sir Harold joined the Ministry of Labour in 1920, and was secretary of a Government mission on industrial conditions in Canada and the United States in 1926-27. He served as Chief Industrial Commissioner from 1942 to 1944.

CB

MR. EDWARD ROWLAND ALWORTH MEREWEATHER, Senior Medical Inspector of Factories, Ministry of Labour and National Service.

ORDER OF ST. MICHAEL AND ST. GEORGE

CMG

MR. EDGAR RILEY WILKINSON, commercial manager, Central Electricity Authority.

ORDER OF THE BRITISH EMPIRE

GBE

SIR JOHN MORISON, chairman of the Iron and Steel Holding & Realization Agency since 1953. Sir John was formerly a director of Guest, Keen & Nettlefolds, Limited, and of the Finance Corporation for Industry, Limited. From 1942 to 1945 Sir John was director-general of the finance and contracts branch of the Ministry of Supply, while in 1936 he was appointed a member of the McGowan Committee on Electricity.

KBE

SIR HUGH EYRE CAMPBELL BEAVER, for public services and services to industry. Sir Hugh, recently chairman of a Government committee formed to make an inquiry into the problems of air pollution, has also served as chairman of the Advisory Council for Scientific and Industrial Research and of the British Institute of Management.

SIR CLAUDE DIXON GIBB, chairman and managing director of C. A. Parsons & Company, Limited, marine engineers, etc., of Newcastle-upon-Tyne. Sir Claude is also chairman of A. Reyrolle & Company, Limited, manufacturing electrical engineers, of Hebburn (Co. Durham), and of the Parolle Electrical Plant Company, Limited. Born in Australia, Sir Claude joined C. A. Parsons & Company in 1924 and was appointed to his present positions with the company in 1945. During the last war he served as Director-General, Weapons and Instrument Production and later as Director-General, Fighting Vehicles (Research and Development). In 1951 he was appointed a member of the Scientific Advisory Council of the Ministry of Fuel and Power.

CBE

MR. H. V. DISNEY, chief engineer at the industrial group headquarters at Risley of the United Kingdom Atomic Energy Authority; MR. H. F. HODGSON, managing director of Joseph Sankey & Sons, Limited, sheet-metal manufacturers, of Bilston (Staffs). He is also a director of Garringtons, Limited, Wednesbury, Guest, Keen & Nettlefolds, Limited, John Lysaght, Limited, and Welsh Metal Industries, Limited.

MR. CHRISTOPHER MACRAE, secretary of the Scottish Council (Development and Industry).

MR. HARRY RICHARDSON, principal of Bradford Technical College; MR. T. A. ROGERS, Deputy Chief Inspector of Mines and Quarries, Ministry of Fuel and Power; MR. R. S. STAFFORD, technical director of Handley Page, Limited; MR. GERALD STEEL, general managing director of the United Steel Companies, Limited.

COL. G. C. H. HAMILTON, chairman of the Expanded Metal Company, Limited, and Tarslag, Limited.

MR. G. F. D. WADE, for political services in Warwickshire. Mr. Wade is joint managing director of Charles Wade & Company, Limited, iron and steel stockholders, of Birmingham.

(Further Honours to be listed next week)

Conversion of Cupolas from Cold to Hot Blast, and Operating Economies*

By R. Burleigh

Mr. Burleigh is works manager and director of International Combustion, Limited, Derby, a post he has held since 1947. He commenced his career with Richardsons Westgarth Company, Limited, leaving that firm in 1935. Then he joined his present company, spending ten years in the drawing office before being promoted to chief operating engineer. In his present position he is, of course, responsible for the firm's foundry and all new plant installed there.

There has been no attempt in this Paper to consider the metallurgical or technical advantages to be gained from the use of hot blast. It is put forward simply to emphasize the really important reduction in fuel consumption as coke saved in foundries becomes available for other industrial or domestic uses. The fuel saving, together with the reduction in cost of the charge material, brings about a considerable reduction in hot-metal cost which must also be counted in on the overall economic assessment. With the rising costs of solid fuel for melting purposes, there is a tendency to turn toward electric melting, and in countries where hydro-electric generation enables supply costs to be relatively low there is an undoubted advantage to be obtained, especially if any consideration is being given to the production of special irons. In the majority of countries, steam generation is the main source of supply for electric power and therefore costs must inevitably rise as labour costs increase and fuel supplies become exhausted. The advent of atomic-power generation does show some prospect for ultimate stabilization in the cost of electricity supply, but many years must pass before such power generation is a commercial proposition to replace steam generation. Meanwhile, it becomes the responsibility of all manufacturers using solid fuels to effect any economy possible at the present time to conserve supplies until atomic-power generation is really established. It is therefore submitted that to convert existing plant to hot blast is an economic proposition well worthy of consideration, even for medium-size foundries producing grey iron only.

Introduction

The overall economic efficiency of a foundry is very dependent upon the method of melting the iron, mainly because the cost of melting is such a large item in the total expenditure and also because the cost of the finished castings depends on the quality of metal used. With the ever-increasing cost of coal, and the demand for high duty, considerably more attention is now being paid to the melting processes. At one time, cold-blast cupolas were universally adopted for melting iron. Recently, however, hot-blast cupolas were introduced and now, where the price of electric power is favourable, electric furnaces are being used to some advantage.

The decision to modify the melting plant in an existing foundry creates a problem which must be carefully considered from all aspects, with particular attention to the possibilities of building new equipment whilst the existing plant remains in commission, or, alternatively, converting the existing plant with a minimum loss of production. Local conditions and space limitations being so infinitely variable, it is almost impossible to make general recommendations. The object of this Paper, therefore, is to point out the direct economies and advantages effected in converting, rather than rebuilding, an existing cold-blast cupola plant to hot blast in a foundry where the majority of the output castings are in a standard grey iron, wholly absorbed in the manufacture of the products of the company. It is also intended to point out and illustrate diagrammatically how the actual work of conversion was carried out with a minimum of dislocation and interruption to the normal production of the foundry.

Finally, a certain amount of attention is given to the problem of water cooling the melting zone of the cupola, and details will be given of the experimental work and development carried out, together with the results so far obtained. The Paper is being presented at a time when the national

* Paper presented at the European Conference on Recuperators, recently held in Paris.

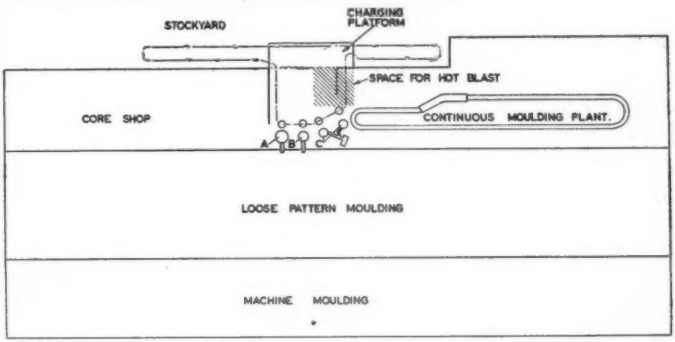


FIG. 1.—*Layout of foundry showing location of melting plant and space available for hot-blast equipment.*

Conversion of Cupolas to Hot Blast

appeal for fuel economy has been intensified and special attention is being given to the economic conversion of waste heat for useful purposes throughout all industries.

Approximately 9 years ago, it was intended that the foundry in which this work had been done should be modified and re-equipped in order to considerably increase production. Fig. 1 shows the main building which consisted of three bays 500 ft. long, the centre bay being 60-ft. span and the two wing bays 45-ft. span. At that time, the output was approximately 100 tons of finished castings per

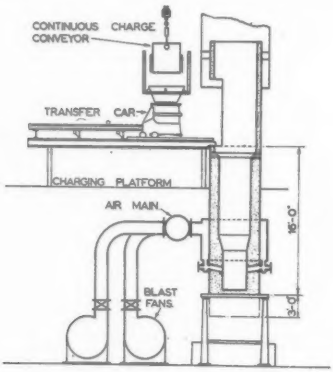


FIG. 2.—*Diagrammatic arrangement of the plant before conversion.*

week and it was estimated that by suitable mechanization the output could be raised to 250 to 300 tons per week, without any major alterations to the buildings.

Attention was first turned to the melting plant in order to ensure that when all the mechanical improvements had been carried out the supply of hot metal would be adequate to meet the new demand. The melting plant consisted of four cupolas as follow:—(*a*) One with 10-ton capacity which was used daily in the afternoon to provide metal for the centre bay in which all the heavy loose-pattern castings were produced. (*b*) One 3-ton capacity used only twice weekly for the limited production of special irons. (*c*) Two 6-ton capacity which operated on alternate days to provide metal for the continuous moulding plant situated in the wing bay adjacent to the cupolas. The melting time for these was 8 to 9 hours per day.

All cupolas were together and sited at mid length of the wing bay with pouring spouts delivering to the centre bay. Charging was by hand from a platform served by an overhead crane bringing material from the stockyard. After due consideration the modifications to the cupola plant were finally decided upon as follow:—(1) Rebuild all cupola shells which were approximately 18 years old and due for replacement. (2) Increase the size of cupola B from 3 to 6 ton. (3) Raise the level of the pouring spouts on the two cupolas C and instal a hot-metal receiver which would deliver direct into ladles suspended from an overhead track and travel to the pouring point for the continuous plant. This modification actually reduced the height of the cupola stacks as without major building alterations it was impossible to raise the level of the charging door. Eventually this feature proved to have a high nuisance value and will be examined again further on in the Paper. (4) Instal mechanical charging equipment for all cupolas as great importance had been attached to the necessity of having a rigid and accurate control on all charge material. It was

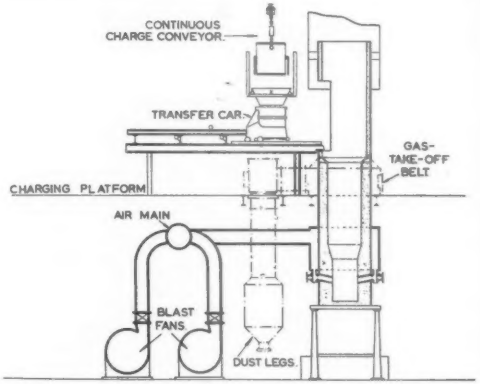


FIG. 3.—*First modification to provide space for gas take-off belt and dust legs.*

realized that the cupola plant was not ideally situated for the ultimate development of the foundry, but the difficulties surrounding the problem of setting up the cupola plant on a more suitable site were considered too great, with the result that very special mechanical charging equipment was

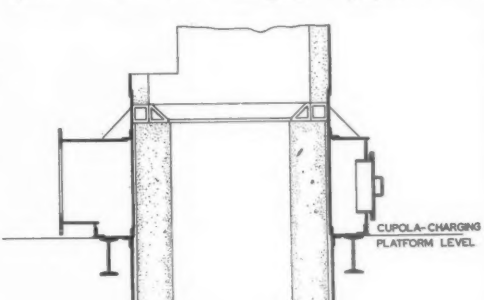


FIG. 4.—*Fabrication of the gas take-off belt around the cupola shell.*

designed and installed to service the cupolas from the existing stockyard, and retain them in their original position.

At that time the question of installing hot-blast equipment for the two cupolas C was examined and it appeared that economically it would be ineffective. The space available for the installation under consideration was extremely limited and inadequate for the type of equipment offered. This fact, together with the adverse reports received on the high cost of maintenance for the heat exchangers finally swayed the decision against the conversion.

Some considerable time later, a problem arose of producing castings for pressure vessels with a specified and guaranteed sulphur-content. The percentage of rejected castings was very considerable due to the high sulphur-content only, and it was apparent that hot-blast cupolas could be used with considerable effect to reduce the average sulphur-content the small amount necessary for the guaranteed figure. The question of conversion was reopened and enquiries pursued to find the improvements which had been made in the development of hot blast during this lapse of time. The problem of installation was now considerably aggravated due to the added charging equipment around the cupolas and it seemed extremely unlikely that a suitable design could be got out to suit the space available and operate satisfactorily with the relatively low level for the gas take-off belt. It was found by proposing the Schack spiral-type recuperator that the space available, although very limited, was sufficient to give a good plant arrangement. The results obtained from tests taken on the cupola gas showed that even with the short stack height there were reasonable possibilities of obtaining good operating conditions. The decision to instal hot-blast equipment for the two cupolas C was finally taken with the full knowledge that the work would be difficult to carry out under the limitations previously described, added to which the total time allowed for a complete shut down was only the two weeks of the annual holiday. Consequently, arrangements had to be made to erect as much equipment as possible prior to the holiday, leaving only the actual work in the cupola to be done as the final operation.

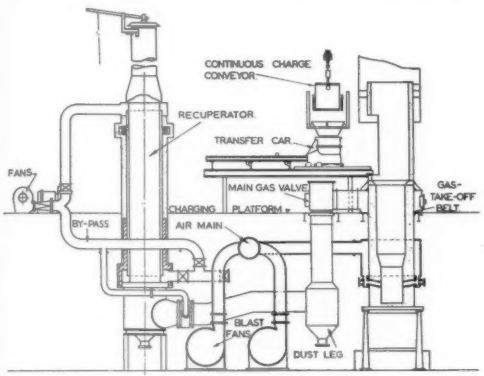


FIG. 5.—*Hot-blast equipment installed prior to the changeover.*

Details of the Methods Used

The arrangement of the cupola plant before conversion is shown diagrammatically in Fig. 2. The space for the gas take-off belt was obstructed by the supporting structure of the transfer car of the cupola-charging conveyor. In addition, the original blast fans were arranged to supply air through a manifold to the four cupolas, and as such they occupied the space required for the dust legs in the gas ducts.

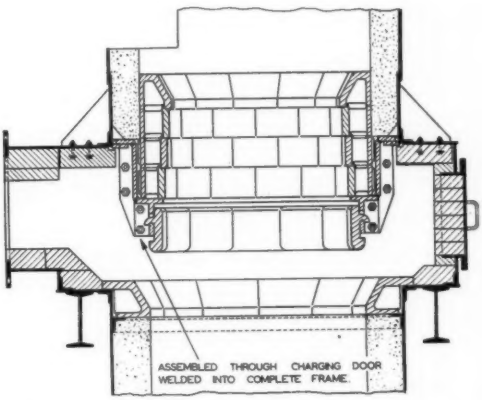


FIG. 6.—*Completion of the gas take-off belt.*

The space of 3 ft. below the cupola is the amount of stack height which was lost when the tapping holes were raised, to suit the addition of the hot-metal receiver.

Fig. 3 shows the first alterations required. The fans and manifold were moved to a temporary site and recoupled to the four cupolas. The supporting structure of the charging car was modified and additional steelwork to support the take-off belt and gas valve was incorporated in the charging platform.

It was now possible to erect the take-off belts round the cupolas, leaving the shell plates undisturbed. Fig. 4 shows the design adopted which could be constructed in small components and easily assembled and welded to form a complete and substantial unit. The whole of this modification was carried out without interference to the normal working hours.

With the site now effectively cleared, work could continue on the erection and installation of the remainder of the equipment and Fig. 5 shows the arrangement of the plant now ready for the final changeover, leaving only the cupola linings, the gas take-off belt, wind-box, and closing lengths of ducting to be completed in the shut-down period.

To enable the erection of the coolers and wind-

Conversion of Cupolas to Hot Blast

box to proceed simultaneously with the completion of the take-off belt, a blanking disc was built into the cupola. With this arrangement the shell of the cupola could be cut away at the take-off belt and the supporting frame for the cast-iron lining bricks be built into position. The frame was designed to be inserted in sections through the charging door and assembled as a complete unit in position as shown on Fig. 6.

At the wind-box level, the cupola linings were taken out and the wind-box dismantled, the shell plates could then be modified to accommodate the coolers and the new wind-box. The erection of the coolers and the wind-box was then completed. The coolers as illustrated in Fig. 7 having been designed to be inserted through the bottom doors of the cupola.

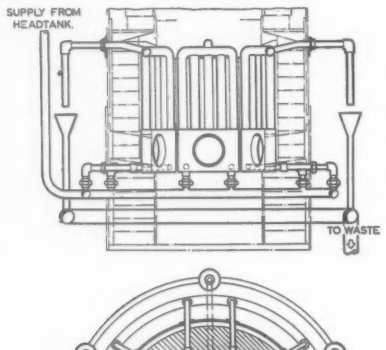


FIG. 7.—*Arrangement of coolers at the melting zone.*

The work of completing the conversion which has now been briefly described was carried out successfully in the two weeks' holiday period and Fig. 8 shows the arrangement of the completed plant as commissioned.

Economy Effected

The second part of the Paper is confined to a simple study of the economy immediately effected by the use of hot blast. The records of the plant charges for the four months prior to conversion were examined and are set out in such a way to form a direct comparison with charges subsequently used. Table I shows these results and the direct saving in cost per charge.

The comparative costs of maintenance have also been drawn up and set out in Table II. Although these cannot be considered in any way final as the plant, having operated for 14 months and only running maintenance costs are available, they do give a clear indication of the saving so far effected.

TABLE I.—*Results and Savings.*

Material charged.	Cold blast. Weight.	Cold blast. Cost.	Hot blast. Weight.	Hot blast. Cost.
	cwt. qr. lb.	£ s. d.	cwt. qr. lb.	£ s. d.
Pig-iron A ..	1 2 0	1 1 9	1 2 0	1 1 9
Pig-iron A ..	1 2 0	1 1 9	—	—
Pig-iron B ..	1 0 0	1 6 3	1 0 0	1 6 3
Shop scrap ..	2 0 0	0 15 0	2 0 0	0 15 0
Bought scrap ..	3 0 0	1 2 6	4 0 0	1 10 0
Steel	—	—	0 2 0	0 2 3
Coke	1 2 0	0 12 6	1 0 0	0 8 4
		5 19 9		5 3 7

Actual saving per charge 16s. 2d.

Pig-iron A is given twice in the table as it represents a medium-phosphorus iron and the usual practice was to use two varieties in the charge make up. Pig-iron B is a low-phosphorus iron. The reduced cost of 16s. 2d. per charge represents a saving of 13¼ per cent. based on the original costs.

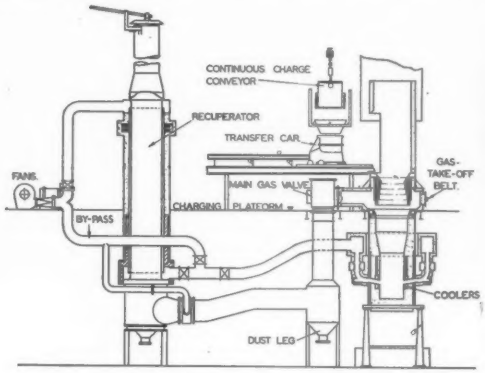


FIG. 8.—*Complete plant arrangement.*

TABLE II.—*Maintenance Costs.*

	Cold blast.	Hot blast.
Daily repair of lining ..	6 cwt. ganister per day 6 to 8 hours	3 cwt. ganister per day 4 hours
Re-bricking during normal running	8 to 10 bricks per week	Nil.
Half annual re-bricking	1,500 bricks (2 men 2 days)	No re-bricking yet after 14 months running.

The gas consumption of the recuperator was checked for the cost to be offset against the coke saving.

Average daily consumption (Monday to Friday) ..	63 charges
Average Saturday-morning consumption	35 charges
Total charges per week	350
Savings per week at 16s. 2d. per charge	£282 18s. 4d.

It is now possible to draw up a general summary of the saving effected:—

	£ s. d.	£ s. d.
18 cwt. ganister per week	2 15 0	
Labour, 21 hours at 5s.	5 5 0	
		8 0 0
		290 18 4
Less increase in cost of gas		6 0 0
Nett weekly saving		£284 18 4
Annual saving on 49 working weeks		£13,965 0 0

As the capital cost of the conversion including modification to the building was £13,800, it shows an equivalent to the saving on one year's running cost.

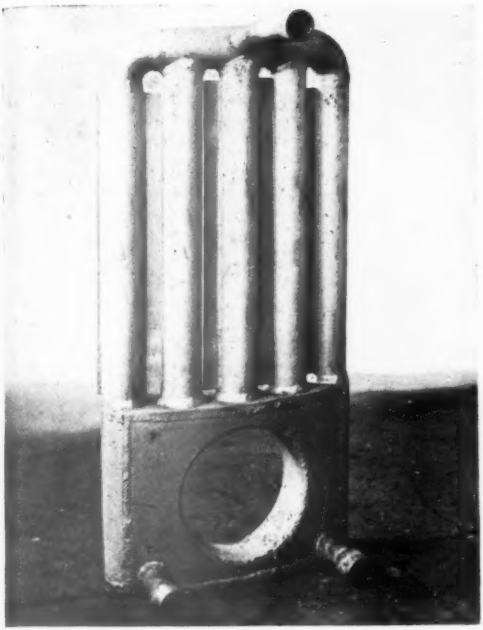


FIG. 9.—*One section of the tubular panel coolers.*

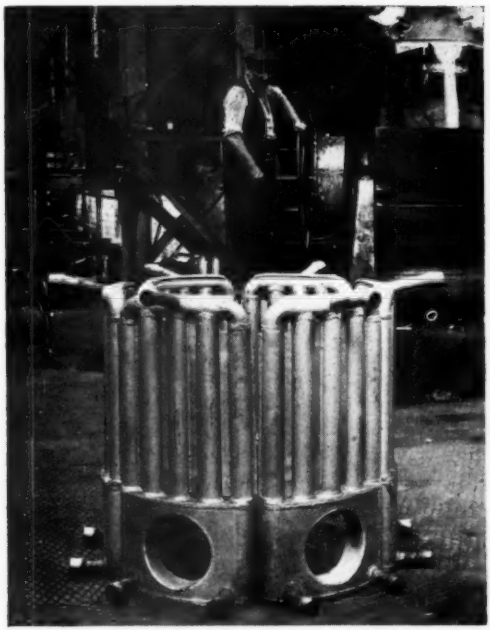


FIG. 10.—*Complete assembly of the panel coolers.*

It is of interest to note that the actual annual weight saving in coke is 428 tons.

It should be mentioned here that except for the sulphur-content, there was no deliberate intention to change the composition of the iron in any way. A review of the analysis records taken before and after the conversion show the satisfactory results obtained; these are as follow:—

Metal Analyses.

	Total carbon.	Silicon.	Manganese.	Sulphur.	Phosphorus.	Chromium.
Cold blast..	3.19	2.05	0.69	0.121	0.95	0.11
Hot blast ..	3.27	2.01	0.61	0.104	0.86	0.08

The average figure for sulphur-content before conversion is given as 0.121 per cent. The specified maximum sulphur-content for the castings previously referred to was 0.12. It can now be appreciated that the reduction of the sulphur-content with the conversion to hot blast immediately eliminated the rejection of castings due to high sulphur-content, which had taken place with the castings produced with the cold-blast cupola.

Water Cooling

Dealing finally with the water cooling of the melting zone, this problem was examined in some detail, considering the possibilities of various methods such as sill boxes, water-cooled tuyère boxes and external cooling. It was eventually decided to make a rather different approach to the problem with the object of recovering any heat extracted from the cupola linings.

A form of finned tubular panel cooler was developed as shown in Fig. 9 which could easily be inserted through the cupola bottom. These panels could be arranged in the cupola to provide a complete protection for the tuyères and the melting zone linings. This feature is illustrated in Fig. 10 which shows a complete assembly of the cooling panels. A supply of water was taken from a head tank and connected to the bottom box of the panels.

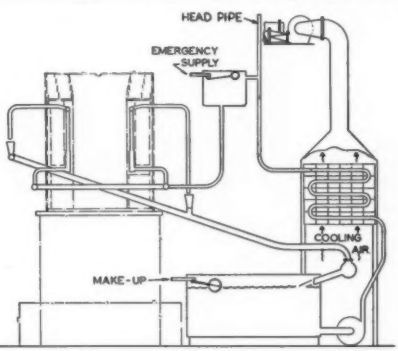


FIG. 11.—*Diagram of cooling-water circulatory system.*

Conversion of Cupolas to Hot Blast

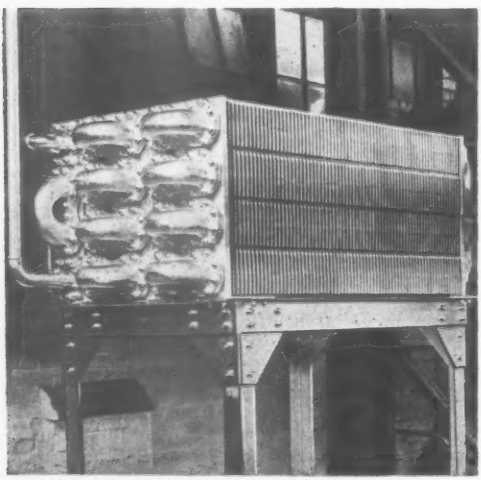
The water rising freely through the cooler was again collected through a ring main and run to waste. Tests taken with this arrangement quickly proved the necessity for a reasonably high head of water to ensure positive flow at times when steam was being formed in the cooler. Although large quantities of heat were carried to waste by this application of coolers, no detrimental effects were observed either on the linings or on the metal produced. It was then decided to recover this heat by using a heat exchanger and the plant was modified as shown in Fig. 11 by the addition of tanks, pumps and air coolers and with this arrangement it was possible to increase and control the flow of water through the coolers. The quantity of water being circulated was finally raised to 66 galls. per min. Fig. 12 shows the type of air cooler installed and although not especially designed for this duty, as a standard article of unit construction it was immediately suitable for experimental uses.

Heat Exchange

Although the heat exchanger had a low efficiency there was sufficient evidence to show that heat taken from the cupola could be readily absorbed for other purposes and at the same time reduce the water consumption to a negligible amount. The final stage of this experiment was to cloak the heat exchanger with a hood coupled to the cupola fan suction. It was now possible to take a simple test and the following results were obtained:—

	Per hr.
BThU's taken from cupola in cooling water	673,000
BThU's returned to cupola in blast air	277,000
BThU's available for domestic uses ..	362,000
Losses assessed at 5 per cent.	34,000

FIG. 12.—*Experimental air cooler.*



It is not suggested at this stage that any advantage is obtained by preheating the air to the recuperator. Further tests are being taken to find the economic value of this feature, if any. Whatever the results of these tests show, it can, however, be pointed out that there is available a supply of heat approximately 4,500,000 BThU's per day, which could readily be used for space heating or for domestic water supply. The excellent outlet for this heat supply is to provide hot water through a heat exchanger for the foundry baths, as this provides a demand constant to the foundry working hours, whereas by using the supply for space heating only, the demand is extremely variable.

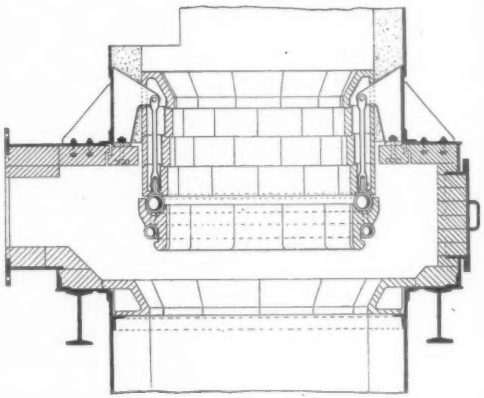


FIG. 13.—*Alternative design for water-cooled supports for cast-iron bricks at gas take-off zone.*

Referring again to the short stack height of the converted cupolas, it should be mentioned that trouble was experienced with ignition of gases in the take-off belt which resulted in high temperatures and ultimate distortion of the supporting frame for the cast-iron bricks. Although the trouble was partly prevented by changing the size of coke and charge material and also modifying the operating procedure, there was still a certain amount of uncertainty in obtaining really satisfactory conditions.

Rather than risk a high maintenance cost on supporting frame replacements, the design is to be changed to give water-cooled construction and still maintain the original profile of the inlet well. This feature is illustrated in Fig. 13 and should be compared with Fig. 6. The cooling water will be circulated and form part of the main water supply to the melting zone coolers.

Acknowledgment

The Author wishes to thank the directors of International Combustion, Limited, for permission to publish this Paper.

MILFORD DOCKS COMPANY—Lord Craigmyle has joined the board.

Institute of Metals Awards

The Council of the Institute of Metals has announced the following 1956 awards of medals:

Institute of Metals Platinum Medal to Professor Georges Leon Chaudron, Sorbonne Professor and director of the Vitry laboratory of the *Centre National de la Recherche Scientifique*, in recognition of his outstanding contributions to knowledge, particularly in the field of the light metals, which have greatly benefited the metal industries; Rosenhain Medal to Dr. Donald McLean (principal scientific officer, metallurgy division, National Physical Laboratory, Teddington) for his work in the field of physical metallurgy; W. H. A. Robertson Medal to Mr. E. J. Thackwell (Northern Aluminium Company, Limited, Rogerstone, Mon) for a paper on "Monolithic Linings for Twin-bath Induction Furnaces for Melting Aluminium Alloys."

Plaque of the Duke

Just before Christmas, the Duke of Edinburgh unveiled a cast-bronze plaque of himself—shown in the accompanying illustration—at the St. Andrews Home and Club, Westminster, London, when he visited the premises as patron of the London Federation of Boys' Clubs. The modelling of the head was done by W. G. Mochrie (late secretary of the London branch of the Institute of British Foundrymen) and the plaque was cast and mounted, along with its engraved tablet, at the Morris Singer art foundry, under the supervision of Mr. A. L. Parrott. The plaque was presented by Mr. A. R. Wizard, a prominent member of the Institute, and chairman of the St. Andrews Home and Club.

Cast plaque of the Duke of Edinburgh modelled by Mr. W. G. Mochrie and presented by Mr. A. R. Wizard to the St. Andrews Home & Club, Westminster.

Correspondence

VALEDICTORY NOTE

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—On relinquishing office as president of the International Committee of Foundry Technical Associations, I want to thank the past-presidents, the members, and the secretary for all their co-operation and help during the year. As previously stated, it has been an interesting and very pleasant experience and I am very happy to have been able to serve in the development of this sphere of activity.

I congratulate the coming president, Mr. Max Vuillemieur, and the vice-president, Dr. A. B. Everest, and wish them the best of good luck at their congresses—in Düsseldorf, 1956, and Stockholm, 1957.—Yours, etc.

Y. GRANSTROM.

Allmänna Svenska Elektriska Aktiebolaget, Sweden.

Permanent Instrument Exhibition

A permanent exhibition by member firms is to be opened by the Scientific Instrument Manufacturers' Association at their headquarters at 20, Queen Anne Street, London, W.1, on February 9. It will cover an entire floor, which has been completely redecorated in modern style. Since sufficient space is not available to enable all member firms to show their products at the same time, space is allocated by ballot for limited periods, so that the exhibits will constantly change. While the exhibition is not intended to be public, it will be open to anyone interested in using any of the wide variety of instruments manufactured by Association members. Overseas visitors especially should find the show useful, since they will be able to inspect there equipment made by firms from all parts of the country. A comprehensive library of members' catalogues is also being established.

Forty Years Ago

In the issue of the FOUNDRY TRADE JOURNAL for January, 1916, the Editor expressed the idea that excessive overtime was to be deplored and that the provision of better tools would probably render a longer working day unnecessary. An early article on oil-sand cores by Mr. J. G. Robinson appeared and it is evident from the discussion that the method, though in its infancy, was widely used. The author was reported to be making large quantities of bomb castings using oil-sand cores. The death was reported of Mr. Adolphe Greiner, managing director of John Cockerill, Seraing, Belgium, and president of the Iron and Steel Institute. Amongst new companies registered appeared the names of the Caledonian Foundry, Limited, of Greenock, and Phoenix Castings, Limited, of Coventry.

International Foundry Congress

The dates of the International Foundry Congress, 1956—September 1 to 9—have already been announced and the following particulars of the general programme have now been given:—September 1 (Saturday): Opening of the Congress and Fair; (Sunday) Rhine journey; (Monday) special event "Constructing and Casting," also inspection of works; (Tuesday) inspection of works; (Wednesday) papers and lectures all day; (Thursday) papers and lectures all day; (Friday) inspection of works; (Saturday) official closing of the Congress; (Sunday) departure to southern Germany for a circular tour, and inspection of works in that area.

Disastrous Effects of Legislation

How quickly—and how disastrously—Government edicts and the actions of nationalized industries can affect private manufacturers is illustrated by the experience of Sidney Flavel & Company, Limited, as told by the chairman, Mr. Duncan Wright, in his statement to shareholders. The company makes gas and solid-fuel appliances and in February last, owing to the imposition of hire-purchase restrictions and the introduction of a stock-reducing campaign by the Area gas boards, it was faced by a virtually non-existent market for gas appliances. This cessation of buying came at a time when the firm was geared to maximum production and was a blow of the greatest severity. It caused an immediate interruption of the manufacture of gas appliances, the cancellation of orders for supplies, the loss of some 300 trained personnel, and the expense of considerable disorganization.

Sidney Flavel managed to expand its engineering production to take up some of the slack, but the chairman nevertheless estimates that there was a £400,000 loss of turnover, and a substantial contraction in profits was sustained.

The Government, of course, has to consider the national economy as a whole and no doubt its decision to impose restrictions on the sale of gas appliances was the right course to adopt in the circumstances; and if the gas boards were overstocked they cannot be blamed for refusing to buy more. The combined effect on the suppliers of the appliances and their employees was nevertheless unfortunate. It is unlikely that all the gas companies existing before nationalization would have simultaneously adopted the same course; thus the blow would have been softened and its impact spread. There was a flexibility in the days of private enterprise which is completely lost when there is only one buyer.

"Jimmy" Timbrell Retires

On December 23, in the canteen of the Yorkshire Repetition Castings Company, Limited, Mr. James Timbrell was, on the occasion of his retirement, presented with an electric clock. Mr. W. Taylor, in making him the presentation, referred to his 16 years as foundry superintendent and the high esteem in which he was held by the whole staff for his qualities as a practical foundryman and as an executive. Mr. Timbrell, a past-president of both the Lincoln section and the West Riding of Yorkshire branch of the Institute of British Foundrymen has given many papers on specialized subjects to foundrymen, based on experiencies garnered during his 54 years' association with the industry. Replying to a toast to his health and future happiness in his retirement, Mr. Timbrell said he took pride in the fact that since his appointment the firm had been free from industrial disputes. The shops were happy, well above the usual standard and manned by an efficient and co-operative team.

Copper Goods Prices Defended

For many of the products made by members of the Cold Rolled Brass and Copper Association the margin over the cost of metal at which many of their customers bought strip was about 100 per cent. above 1939 prices, or only about half the general increase in selling prices, stated Mr. N. I. Bond Williams, chairman of the association, in Birmingham. Mr. Bond Williams said the association had always accepted as a duty the need for positive action in improving the quality of its products and reducing its selling prices in step with its improvements in productivity and cost reduction.

Services to Health

Most people have been gladdened by the prospect of purer air in which to live and work which will be afforded by the Government's Clean Air Bill. Its enactment may go far in removing an enemy of good health; if it does the gratitude of everyone will be due to the Government Committee on Air Pollution, whose recommendations provided a basis for the contents of the Bill. Recognition of this due has been accorded to the chairman of the committee, Sir Hugh Beaver, and his deputy chairman, Sir Roger Duncalfe, by the Royal Society of Health, which has conferred Fellowships of the Society on them.

Sir Hugh Beaver, who is 65, was last year appointed chairman of the Advisory Council for Scientific and Industrial Research, to which he was first appointed in 1952. Apart from his duties as managing director of Arthur Guinness Son & Company, Limited, he has devoted much time to the chairmanship of the British Institute of Management and has served on several other Government committees.

Sir Roger Duncalfe became chairman of British Glues & Chemicals, Limited, in 1946. He is a vice-president of the Federation of British Industries, on whose behalf he has served in a number of capacities. Industry as a whole, however, will probably be most grateful to him for his services with the British Standards Institution of which he was chairman from 1948 to 1952, when he became a vice-president. In 1950 he was appointed to the general board of the National Physical Laboratory.

Horse-play at Foundry School

A sheriff, on December 20, criticized the lack of supervision at a Dundee foundry apprentice training school where a boy was stretched out on a "rack" between two machines and apprentices were tarred and feathered. After hearing a trial at which most of the witnesses were 16-year-old apprentices, Sheriff Inglis said: "It seems to me intolerable that such a state of affairs exists that boys can tar and feather and rack each other *ad lib*, to fill in the tea break. Disciplinary supervision seems to be completely absent." Solicitor Mr. J. D. Laverock, defending, said: "That seems to be the case in all factories." The sheriff replied: "Now these incidents have come to light, I hope that a much higher degree of supervision will be exercised in similar schools." He found not proven a case against a 16-year-old apprentice who was alleged to have helped another apprentice—previously put on two years' probation—to put a 16-year-old workmate on the "rack."

Bid for Millspaugh Unconditional

It is announced that the bid of Hadfields, Limited, steelmakers, of Sheffield, for Millspaugh, Limited, the Sheffield board- and paper-making machinery manufacturers, has become unconditional.

The offer consisted of two Hadfields £1 ordinary shares for seven Millspaugh ordinary 2s. 6d. units. Holders who have accepted will receive in addition to Hadfields' final dividend that of Millspaugh in respect of the financial year recently completed.

Following the declaration that the offer had become unconditional, Mr. K. F. Landegger, one of the three Millspaugh directors who opposed the bid, announced that he was himself to offer 10s. for the 2s. 6d. ordinary units as would make his holdings, with those of his friends, amount to 50 per cent. of the issued ordinary capital.

Gases in Cast Iron

Discussion of the Joint Committee Report Compiled by H. Morrogh.*

That the use of the vague expression "oxidized iron" should be discontinued is the lesson to be learned from this congress discussion—not so much because it is wrong (even at present opinion seems divided on this score) but because extreme caution should still be used when attributing anomalies to the influence of the gaseous element in cast iron. Comment included reports of similar work carried out in other countries and attempts to explain the findings in terms which would be of practical application by ironfounders. One member did in fact relate the measures he intended to take in his foundry as a result of the committee's work.

Mr. H. J. V. Williams, who as joint chairman of that session of the International Foundry Congress in London introduced the final item:—"Gases in Cast Iron," a report of the Joint Gases Committee of the Institute of British Foundrymen and the British Cast Iron Research Association, said he thought Mr. Morrogh who was presenting it really needed no introduction. All foundrymen knew his name; and to most of them he was a familiar figure. Mr. Morrogh was the chairman of the joint body which had prepared the report.

Mr. Max Vuilleumier, opening the discussion, said it was a great honour for him to be present at a conference where such a world-famous man as Mr. Morrogh was presenting a report. In Swiss foundry research circles, he was well known for his work and studies on cast iron and was very much appreciated for it. It was for all a most interesting experience to have him speak about gases in cast iron.

German Research

DR. A. WITTMOSER, of Germany, congratulated the committee on the work which had been done, for it would form a good background. In his country, the committee on grey cast iron of the German Foundrymen's Association had been trying for many years to find a relation between the total gas content of pig-iron and the quality of grey cast iron melted from it, but unfortunately they had not yet got any results. However, they had found that there was a difference in the possibility of lowering the gas content of several pig-irons through the melting methods employed. He thought it was necessary when speaking of gas content of cast iron to differentiate between the effect of alloying and the effect of the combinations accomplished. He felt that the total gas content of a grey cast iron was not the main point of the problem. The problem was the status of conjunction between the gases and other elements present. From that aspect, the German workers hoped to be able to continue and eventually solve the problem of the gas content.

The first step had been taken when it was found[34] that for different grey cast irons and pig-irons there was a different temperature at which oxides could be reduced. In one case, the gas content was found to be reduced in the higher range of temperatures. It would seem that the presence of different oxides in the iron influenced *this* gas content, which was responsible for failures in castings.

In addition, there had been developed in Gelsenkirchen a method to isolate inclusions and several other constituents of the matrix of grey cast iron by electrolytic methods[35, 36]. Next it was hoped they might be able to find out more about the form and conjunctions of gases in grey cast iron. Naturally, the German research team were very interested, too, in the methods for determining the total content of gas in grey cast iron to confirm the findings of the electrolytic isolation.

MR. MORROGH said he had been privileged to see some of Dr. Wittmoser's work in his own laboratory and he was sure that the results would prove of great value and interest. From his remarks he believed there was no fundamental disagreement between his point of view and that of Dr. Wittmoser. He had tried to recommend the view, and he thought this was expressed in the report, that whereas the oxidation of molten cast iron might have some influence on chilling tendency, annealability, and so on, the observed differences were not necessarily due to variations in oxygen content itself, but to the extent to which elements such as aluminium and titanium were removed by oxidation and neutralized by the residual oxygen content.

The results presented in the report showed oxygen to be a neutral element. Instead of discussing the manner of combination of the oxygen it would appear more relevant to try to find out how elements such as aluminium and titanium were combined. The anomalies did not appear to be due to variations in oxygen content, or to the manner of combination of the oxygen, but rather to variations in elements such as the so-called residual elements and the manner of their combination.

MR. G. BLANC (France) (director of Research of the *Centre Technique des Industries de la Fonderie*) said Mr. Morrogh was to be congratulated for his clear and thorough review of the considerable work that had been done in Great Britain during the last few years on gases in cast iron.

Attention in France had also been applied to the importance of this problem and, at the *Centre Technique* some work in this field was being pursued.

As far as this work has gone, it agrees with most of the points raised by Mr. Morrogh's report, and, in order to make this contribution as short as possible, only the few points on which there

* Printed in the JOURNAL, December 22 and 29, 1955.

were slight differences between Mr. Morrogh's and personal observations would be discussed.

The speaker and his colleagues used the same method for analysing gases, that is, the vacuum-fusion method, which was thought to be correct. However, he could not help being struck by the fact that other workers, using different methods, published figures of a higher order of magnitude than either Mr. Morrogh or the *Centre*, and he thought the reasons for those differences deserved to be systematically investigated.

For practical reasons, the *Centre* had used a different method of sampling, casting bars of ½-in. dia. and 6-in. long, machined to ⅜-in. dia. and four samples for each melt or partial melt that had to be investigated were analysed. The figures were sufficiently consistent and the order of magnitude was the same as Morrogh's. The British sampling method may give a better idea of the gas content of the liquid metal and that of the *Centre* might to some extent take into account the fact that, for unknown reasons, one melt can be more prone than another to gas pick-up from the mould. They used the same moulding material as for the castings, generally green-sand. It was their intention to devote a certain number of melts to a comparison of the sampling methods.

French Results

First of all the French had reproduced previous experiments made by Le Thomas who had shown in 1933 that, if a melt remained uncovered in the furnace in contact with the air for a certain time, say ¼ to 3 hours, though there was only a slight change in composition, the metal had a greater chilling tendency. They had repeated these observations and found a noticeable and regular increase of the gas content as well in O_2 as in H_2 and in N_2, the initial value being rather low in these experiments. However, there was no regular proportion between this increase in gas content and the increase of the chill.

Secondly, he and his colleagues had made very careful experiments, adding mill-scale to the melt and their results differed from Mr. Williams's observations. In fact, just after one added this oxide, the oxygen content was raised and the chilling tendency was not affected, but, if one waited a sufficient time, the composition in both gases and in other elements remaining practically the same, the chilling tendency showed a regular increase. This was noticed after 6 min. and still more after 40 min.; it seemed to be very important.

On the other hand, the French workers quite agreed with Morrogh's results concerning the so-called "deoxidizers," at least some of them, such as ferro-silicon; the tendency to chill decreased without any relation to changes in gas content, these changes being insignificant. However, the addition of magnesium alloys lowered considerably and immediately the oxygen and nitrogen content, the hydrogen content seeming to be slightly increased.

From these and from many other experiments that will be reported later, he quite agreed with Mr. Morrogh's conclusion that there was no simple, or direct relation between the gas content and the properties of cast iron, but that changes in gas content greatly merited attention and such investigation could certainly contribute to a better knowledge of foundry operations.

He thought it could be said about oxygen, hydrogen and nitrogen contents what was well known and well established for the total-carbon content: two irons with the same total carbon could have very different properties, which depended principally, but not only, on the form under which the carbon was present, that is, combined or graphitic, and in the latter case on the shape of the graphite.

Just as one analysed an iron for total carbon, it was quite reasonable to investigate what they considered to be the total gas content, and even if this knowledge was not all, this field of investigation was, no doubt, a very fruitful one. It was necessary in the meantime to bear in mind that another aspect of the problem would have to be approached, probably more fruitful still: that was the form of the gases present, not only in the solid metal, but also, as difficult as it might seem, in the liquid metal itself. That was looking to the future, but he considered it safe and sound to think of it from now on.

Critical Survey

MR. MORROGH said he was pleased to note that the work of Mr. Blanc to some extent confirmed the British work. However, in connection with the remarks on the influence of mill-scale additions, he thought the results should be interpreted differently. Mr. Blanc had reported that an addition of mill-scale caused an increase in chilling tendency on holding the melt after the addition. He suggested that all melts showed this effect, whether one made such an addition or not. Furthermore, the variations in chilling tendency could be obtained by variations in melting temperature and casting temperature, and unless these were held constant one could obtain some erroneous impressions about the influence of various additions.

He had had the opportunity to study the results reported by Mr. Blanc and felt that he was not entirely justified in drawing the conclusions which were outlined. He claimed that additions of mill-scale to melts which had already been treated with ferro-silicon resulted in a more rapid increase in chill on holding the melt than when ferro-silicon additions were made alone. A study of the results reported by Mr. Blanc showed that these conclusions were based on two melts which did not have the same thermal history, the melting temperatures and pouring temperatures differed. In such cases it was not possible to make a comparison, since variations in melting and pouring temperature had a great influence on chilling tendency. Furthermore, it appeared that the amount of ferro-silicon used was different in the two cases.

Mr. Blanc had referred to the use of sand-cast samples. The work in Great Britain had shown such

samples to be somewhat unsuitable. Recent American work had shown that grey-iron samples absorbed oxygen on standing so that oxygen contents obtained on grey-iron samples might be considerably misleading. Mr. Blanc had also referred to the manner of combination of oxygen—he wished to emphasize again that the findings of the present work were that oxygen was a neutral element and only had an effect in so far as it neutralized or removed other elements from the melt. He was pleased to note that the general level of gas contents which Mr. Blanc and his colleagues obtained were similar to those obtained by the British workers. He, too, was very concerned about the high values reported elsewhere and thought that some co-operative work was necessary to find out why workers in other countries obtained such high values.

MR. BLANC wrote, in continuance of the verbal discussion, saying that it was quite right that the chilling tendency of a cast-iron melt increased with time, but in the case of mill-scale additions the increase was much more rapid than without such additions. The increase for the " oxidized " iron was, after 6 min., the same as after 30 min. for ordinary iron, and was noticeably larger after 40 min. with mill-scale addition than after 75 min. without addition.

A MEMBER suggested that the question of oxygen content of iron in relation to temperature and composition should be investigated.

Conflict of Opinion

MR. R. C. SIDDALL thought that there appeared to be some conflict of opinion in the report. In one part, the committee gave the impression that there was no such thing as " oxidized iron," that the variances in metal quality could be due to " variations in melting cycle and pouring temperatures," that these were " factors very rarely under precise control in the foundry." He understood that the basis of the report was that there was no measurable nor appreciable difference in oxygen content; he did not question this, he had to take the committee's word for it—but in another part of the report the committee seemed to agree that there was a deterioration in quality when iron was melted under oxidizing conditions, *i.e.*, " it is obvious that ' oxidized metal ' is a very real thing." That, he thought, was true. It might not be due to oxygen content, but did the committee believe or not believe that those oxidizing conditions in the cupola led to a deterioration in metal quality?

MR. MORROGH replied that he was sure the committee would agree that melting under oxidizing conditions could lead to a deterioration in quality. It could remove silicon and carbon, for instance. The only point at issue in this context was whether any variations in quality, which incidentally was a very loose phrase, were due to variations in oxygen content. The object of the report was to suggest that variations in properties following oxidation of the melt were not due to variations in oxygen content itself but to other things, such as the elimination of major and minor elements. These points had been deliberately investigated.

It had been common in the British ironfounding industry to talk of " oxidized metal " and to assume that there was such a thing, even in the presence of the relatively large amounts of carbon and silicon common in grey irons. An experiment had been arranged in which foundrymen deliberately tried to produce " oxidized metal " but it was found that such metal was perfectly normal in all respects when its composition, pouring and melting temperatures had been taken into consideration; in fact, in one series of experiments, in spite of using large amounts of oxidized scrap and very bad cupola practice, the oxygen content found was the lowest which had been recorded.

MR. SIDDALL asked could it not be that the term " oxidized iron " was quite correct, although the oxygen content, as measured from a chilled sample, was no higher? Mr. Morrogh had said that the oxygen content did change outside the cupola, *i.e.*, molten iron picked up oxygen on standing. Possibly, inside the cupola, the metal was oxidized, to a greater or lesser degree, although the oxygen contents of chill-test samples were very similar. Could it not be that there was no more oxygen in the metal because trace elements, such as aluminium, had been oxidized and were no longer in the metal —that, in fact, a specimen of metal was being examined which had previously been oxidized in the cupola and had lost the oxides of some of its constituents.

Background

MR. MORROGH, recapitulating, said Mr. Siddall had asked some pertinent questions about the problem of oxygen in cast iron. It was the intention of the report to indicate the considerable belief in the ironfounding industry that there were special circumstances of melting when the metal became " oxidized " without any apparent change in the nominal composition of the material. These beliefs were widespread, and following this it had been frequently assumed that by melting under oxidizing conditions the oxygen content of the iron could be raised to an abnormally high level, and that as a result of this the properties of the material were impaired in a variety of ways. The purpose of the report was to show that when the oxygen content of cast iron was deliberately varied there appeared to be no subtle metallurgical changes except when small amounts of easily-oxidizable elements, such as aluminium, were already present in the iron. For instance, in the absence of aluminium, the oxygen content of malleable iron could apparently be varied between fairly wide limits without any change in nominal composition and without any apparent effect on annealability. When, however, the malleable iron already contained a small amount of aluminium, the attempt to add oxygen to the material caused the removal or neutralization of this aluminium and there was a decrease in rate of annealing.

From these findings, it appears that oxidation of the melt could have an influence when it involved the elimination or neutralization of easily-oxidized metals. In this sense, oxygen had a negative influence. Oxidation of a melt which did not contain

significant amounts of these trace elements would probably have no influence. When trace elements were exerting a beneficial effect, then oxidation of a melt might have a harmful effect. The committee was anxious in its report to differentiate between the effects of oxygen dissolved in the iron and the influence of oxidation during melting.

Mr. Siddall appeared to argue that metal might be oxidized in the cupola, but that by the time a sample had been taken for gas analysis some of this oxygen had again been lost. There did not appear to be any evidence to substantiate this view. However, even if it were true, which was doubtful, it would not alter the relevance of the oxygen contents of small chill-cast samples, since the results would still be relevant to the properties and behaviour of castings made from the same metal.

Other Important Aspects

DR. R. V. RILEY said he thought there were some aspects of the Joint-Committee's work of which members possibly did not know and which might be interesting. Mr. Morrogh had been too modest and had glossed over the hard work which had gone towards preparing the report. When the committee started operations nearly 10 years ago a carefully worded circular was sent to all iron founders in Great Britain whom the committee thought were likely to be interested in the matter, asking if they could tell the committee of any difficulties in their foundry which they thought were due to the incidence of gas in the metal. Further surveys were made on two separate occasions. It would therefore appear that almost every British ironfounder present might, in the last 10 years, have been connected with the report in some way or other. Members of the Joint Committee were surprised in the final analysis to find how few of the so-called foundry defects when "boiled down" were actually proved to be due to gas differences. The indirect relationships were clearly there, but few defects could be attributed directly to the presence of excess gas in the iron.

Another point to which he would like specifically to refer was the graph, Fig. 23, which concerned the influence of carbon on the solubility of hydrogen in pure iron. That work had been done by an investigator at Cardiff University, and he thought it deserved a special mention, since it was the first fundamental work in which an attempt had been made to find the solubility of hydrogen in iron containing carbon in the percentages occurring in cast iron. The work was continuing and was to be extended to include the influence of the silicon content in cast iron upon the hydrogen solubility. The committee felt that work such as this was gradually leading to a much better understanding of the fundamentals.

Logic instead of Assumption

MR. D. FLEMING, speaking of the factors which worked for or might be connected with oxidation, said he could confirm the experiment to which Mr. Riley had referred. It had been carried out in his works and, he thought, in others also. And, as Mr. Morrogh had said, the oxygen found in the samples was in fact lower than was normally found and, furthermore, it was lower than in a sample taken in the normal course of the run on similar metal earlier in the same "blow."

The foundry staff then immediately altered their opinion on the subject of oxidation and particularly adopted the viewpoint that all iron melted in a normal cold-blast cupola was to some extent oxidized, as was evident by the normal loss of elements such as silicon and magnesium, and there did not appear to be some sudden point where a startling change occurred which resulted in an increase in oxygen content. To talk of so-called "oxidized metal," as some foundrymen did, was to speak of something non-existent. He fully agreed with Mr. Morrogh's line of reasoning that it was subsequent effects, rather than something on which founders could easily blame their troubles, which still needed further investigation.

Finally, he thought Mr. Morrogh and his committee were to be thanked for clearing away much of the misconception under which founders laboured, for pointing out that much more care should be taken in making deductions and that influence of other elements should be investigated more closely to explain some of those curious anomalies, the occurrence of which was common knowledge.

Effect on White Iron

A MEMBER wanted to know if Mr. Morrogh thought oxygen, hydrogen or nitrogen had any influence at all on the properties of cast iron, or if there was any evidence pointing in that direction. He referred to a paper by Mr. Williams, of the British Cast Iron Research Association; an excellent paper in which the author sought to find out why white iron gave very different mechanical properties. He had found close co-ordination between the properties and the dendritic structure. Had Mr. Morrogh any information as to whether gases had any effect in that situation?

MR. MORROGH said, in reply to the first part of the question, that he, personally, had no information on the solubility of other gases—the inert gases, for instance—in cast iron. He suggested that some other member of the committee with more experience in the estimation of these gases might like to comment on this point. With regard to the variation in white-iron structure to which Mr. Thompson referred, Mr. Morrogh said this was not connected with the subject of the report under discussion, but that he would like to draw the speaker's attention to a recent paper by E. Scheil and Pohl in *Archiv. für das Eisenhuttenwesen*, February, 1955, p. 105, in which the investigators had put forward a very reasonable explanation of the two structures, the abnormal one being due to considerable undercooling.

Other Gases

MR. B. B. BACH said he had been a member of the committee for quite a number of years and he

thought he could answer the question relating to the effect of inert gases. The only other possible gases that might be expected in cast iron were helium, argon, etc., and as far as he knew those gases did not dissolve in any molten metal at all. There was, therefore, no reason why they should do so in cast iron.

Other possible gases might be considered, such as sulphur dioxide, but when oxygen was present such gases would normally be included in the total oxygen content.

Problems Unsolved?

MR. E. LONGDEN congratulated the Institute on having secured the services of Mr. Morrogh as the chairman of this important committee. Members would expect that the chairman would not be a party to putting forward any inconclusive matter, so far as his great abilities would permit. However, he happened to have been "a little nearer to the foundry floor" than Mr. Morrogh, and in spite of all that had been said during the discussion, he did not feel that there were sufficient grounds to claim any reasonable conclusions had been arrived at on the gas problem. Gas effects on the quality of castings were very real and appeared quite pronounced under certain conditions, and founders did not know why.

He would suggest that in the study of these gas problems, research workers should start with a pure metal, building up from a pure iron, or nearly pure iron. Those who had to produce steel castings knew that the metal had to be "killed" before pouring it into a mould—a direct treatment for the oxygen content dissolved in the steel. He asked Mr. Morrogh whether the effect of the treatment was direct on the steel or indirect. If the steel was not "killed" the castings would be honeycombed with gas holes.

He thought it far better that committee members should set their feet on the path of true basic investigation before allowing "airy" conclusions to be voiced. He would suggest to the committee that there might be greater consideration given to the direct gas combinations with the metal, itself. Members of the Institute had listened with almost amazement to the excellent Edward William's lecture early in the Congress. If they thought back they would realize the enormous influence on metals exerted by very small percentages of gases. If he remembered rightly, they had been told that certain metals which had hitherto been thought to be of great hardness were shown actually to have malleability when the complete elimination of traces of gases was effected. This was a startling pronouncement.

He referred also to the report: "Effect of Mould Material on the Solidification Rate of Cast Metals," also delivered at the Congress: the members knew of the great influence of mould materials, especially on some non-ferrous alloys. During the discussion of this report, the lecturers had been asked "what benefits actually have been experienced by the members of the committee from their intimate contact with the findings of the report, though probably because of the short time available, little evidence was yet available. He now asked the same question of the gases committee—had the members of the committee been able to use any of the information derived from the study to lead to improvement of their own works practice?

Present Position

MR. MORROGH said he was sure the committee and himself would always defer to the long experience of foundrymen of Mr. Longden's reputation. He wished to point out that the work reported upon was by no means complete; the report was merely a preliminary account of work accomplished. However, he would reiterate the final conclusion which he had recommended when introducing it—it was that in future founders ought to be more cautious when attributing various anomalies to the influence of the gaseous elements. This was not a very sweeping conclusion to have recommended.

In connection with Mr. Longden's comments on steel, he thought that too frequently an attempt was made to draw analogies between steel and cast iron and to expect that what happened in steels also happened in cast irons. It should be remembered, however, that almost all cast irons (with the possible exception of some malleable cast irons) contained such large amounts of carbon, silicon and manganese that the phenomena experienced in steels could not be experienced in cast irons. Relative to steels, cast irons were already deoxidized by virtue of their composition. He sympathized with Mr. Longden's desire for information on the influence of the mould on the gas content of the metal and the effect of that on its solidification. At the moment this presented considerable experimental difficulties, but the subject was one which required investigation.

Committee Member's Viewpoint

MR. H. G. HALL said he thought Mr. Longden's question was intended to be, perhaps, a little provocative. First he would say that he had joined the committee with very high hopes and a lot of what were now known to be wild beliefs. As a practical foundryman, he had expected the committee to embark on work such as that envisaged by Mr. Longden, and in a short space of time find the answer to many of his unsolved problems. The first thing which had really impressed him when attending committee meetings was the extreme difficulty which, in the early days, various very competent operatives found in getting the same gas-analysis result from a similar metal sample. In fact, after sitting on that committee for many years, he would say he was not prepared to accept any of the figures published elsewhere prior to that work, except in the sense that they might, perhaps, convey a trend.

Like many others, he had held strong views about oxidized iron, but he was now completely convinced that it was the oxidation of the iron during melting which was far more important than the residual oxygen content in the iron. In other words, of major significance was the degree to which various residual

elements were oxidized and eliminated. From a practical point of view—and after all some "on the floor of the foundry" wanted to know what they were going to get out of this type of research—it was very difficult for the average foundryman to know what residual elements he had in his iron. It was a very expensive process to estimate such elements and he thought therefore that from the practical angle it was desirable, as a result of this work, to have far more control of the oxidation of the iron than had hitherto been thought necessary. It seemed really advisable to weigh and measure the air used for combustion and to correlate that with the fuels used in order to obtain at any rate a measured degree of oxidation.

Effect of Nitrogen

Much of the discussion had been on oxygen and its effects, but looking at the work as a whole, he thought the most profound results which had been demonstrated were attributable to the effect of nitrogen. For many years, he had been wondering why it was that when one used a lot of steel scrap in a mixture one arrived at a point where it seemed necessary to reduce the percentage of steel scrap or otherwise there were foundry difficulties. In his early days when making high-class motor cylinders, after a three or four weeks' run the chief metallurgist would decide to keep steel scrap out for a week. Similarly he had also in later years been worried because he produced a malleable product which was highly sensitive to graphitization and he naturally wished to use a lot of steel scrap in order to cheapen manufacture. He had been concerned because the increasing use of steel scrap seemed to give annealing difficulties. He suggested that the results proved that the more steel scrap was used the higher was the nitrogen content of the final product. High nitrogen contents of grey cast iron tended to stabilize the carbide and result in a more-massive pearlitic-matrix, and for malleable cast iron the higher nitrogen content did give a coarse graphite, widely-spaced nodules, and rather difficult annealability. The committee had found that high-nitrogen contents caused those things, but it had at the same time found a solution, namely that the nitrogen effect could be offset by aluminium additions. So, in answer to Mr. Longden's question he would say the practical man now had the ability to decide on his future melting plant and to base that decision on much of the work which had been done by the committee.

He himself intended to use a hot-blast cupola, a high percentage of steel scrap along with remedies for the nitrogen content which that steel scrap would produce, and he hoped finally to produce an iron which would graphitize quite easily.

MR. BULL SIMONSEN (Norway) said he had been reading the literature on gases in cast iron for many years and thought that the British Cast Iron Research Association now was leading in that field. It seemed to him that what the various speakers had been saying (in the first part of the discussion) could be summed up in a demand for fractional gas analyses. He was thinking of what Dr. Wittmoser had mentioned about German investigations, and believed this referred to the results which had been published by Siegel, who had analysed specimens at 1,000 deg. C. and then increased the temperature to 1,600 deg. C. Siegel checked two periods when there was used respectively clean or very-rusty steel scrap. The vacuum-fusion analysis at 1,600 deg. C. showed little variation in the amounts of gas given off at that temperature, and these amounts he thought were representing an equilibrium gas content. The preliminary vacuum-heat-extraction at 1,000 deg. C. on the other hand gave varying gas amounts. When rusty scrap had been used, the amount of gas given off early at 1,000 deg. C. was always considerably higher than normally. Siegel thought that when more gas than normal was given off at 1,000 deg. C., this was due to the easily reducible oxides of elements like Mn and others, whereas the amount of gas which came off first at 1,600 deg. C. came from oxides of elements having a high affinity for oxygen like silicon and aluminium. Siegel had confirmed his findings by making analyses of residues.

Fractional gas analyses would, Mr. Simonsen thought, tell quite a lot of the history of the different irons. For instance in the case reported there was a good correlation between the degree of rustiness of the scrap and the oxygen content.

Comparison with Light Alloys

DR. E. SCHEUER remarked he was not an iron-founder, nor connected with gases in cast iron. He was, however, connected with aluminium casting and found it particularly interesting to have this work reviewed, the results of which were so different from what was known about gas in aluminium casting.

His first impression was that he did not envy the committee their job by reason of the difficulty and complexity of the task. The second feature which struck him as surprising was the almost total absence of reference to shrinkage in discussing the effects of gas content in cast iron. In the field of aluminium this was the most conspicuous effect of gas content. Only at one point, almost in passing, Mr. Morrogh mentioned that it might not be so good from the point of view of shrinkage to have the iron completely gas free, a point which had become quite prominent in discussion of aluminium casting techniques. He would like to know if Mr. Morrogh could tell members more about that.

A further point on which he would like to have more information was the exact definition of the oxygen content as determined by the analytical method described. Would oxides of aluminium and silicon be decomposed under the conditions of this test or did it only determine the oxygen in solution in any form in the liquid iron?

MR. MORROGH thanked Dr. Scheuer for his comments and pointed out that the report was lacking in information on hydrogen in cast iron. Much further work was required on this aspect; possibly, hydrogen might be responsible for unsoundness in some castings. The influence of oxygen content on soundness had further been investigated and no effect had so far been determined.

With regard to the determination of oxygen by the vacuum-fusion process, this estimation was carried out under the conditions which were known to reduce oxides such as those of aluminium and magnesium. This subject had been extensively discussed in the literature.

MR. J. MONAGHAN said that in some foundries in the United States it was the practice to add small amounts of boron, in the form of boron-containing ferro-silicon, to malleable iron in order to reduce the annealing time. Did Mr. Morrogh think this effect was due to the boron "tying up" the nitrogen present? It had been found that ferro-silicon containing a small amount of zirconium was more effective for inoculation of cast iron than ordinary ferro-silicon. Was this effect also due to the nitrogen being "tied up," in this case by the zirconium?

MR. MORROGH replied that the influence of boron in relation to nitrogen in cast iron had been investigated by one member of the committee. Briefly, the finding was that whereas the influence of nitrogen could be more or less directly neutralized with aluminium and titanium, the influence of boron was more complicated and not obviously connected with the neutralization of nitrogen. The effect of boron was not understood. With regard to zirconium: this was certainly a powerful nitride former. In some cast irons treated with ferro-silicon-zirconium alloys, it was possible to find evidence of the formation of zirconium nitride in the structure, but this point had not been investigated by the committee.

Types of Shrinkage

DR. WITTMOSER pointed out that in dealing with the question of shrinkage it was necessary to be very careful to separate two factors. The first was the influence arising from the reduction of special inclusions (oxides, and so on) in the solidification range, which would be in the direction of lowering the shrinkage through the production of microporosity. The other influence was the direct one of stopping graphitization. Shrinkage in grey cast iron was very much influenced by the degree of graphitization in the eutectic range, and the influence of several forms of combinations of gases might be different on the stabilizing of graphitization.

MR. VUILLEUMIER, closing the discussion, thanked Mr. Morrogh for his very interesting report and pointed out that there were many elements which might influence the oxygen content of the metal. It was, too, interesting to hear that in another country foundrymen were faced with the same problems as those in his own country, although it might make a considerable difference if one was using a cupola or an electric furnace for melting.

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Company News

ASSOCIATED ENGINEERING HOLDINGS, LIMITED—A final dividend of 15 per cent. makes 20 per cent. for the year ended September 30 on an ordinary capital increased from £1,952,003 to £3,452,003 and follows an unchanged 5 per cent. interim on the smaller capital. The 1953-54 total was 17½ per cent.

YORKSHIRE COPPER WORKS, LIMITED—The company reports larger profits and a higher dividend for the year ended July 31 last. A final dividend of 6 per cent. now recommended makes 12 per cent. for the year, compared with 10 per cent. paid for the previous 12 months. After tax of £650,299 (£666,102), the net profit expanded from £464,911 to £585,744.

AEROPLANE & MOTOR ALUMINIUM CASTINGS, LIMITED—The directors recommend a final dividend of 54 per cent., making a total of 63 per cent. for the year ended September 30, 1955. This compares with 26½ per cent. for the previous nine months. Trading profit for the year amounted to £208,105, against £137,537 for the preceding nine months.

ALBRIGHT & WILSON, LIMITED, industrial chemical manufacturers, of Oldbury—The directors announce that acceptance of the offer to ordinary stockholders of 6,084,852 5s. ordinary shares at 15s. 6d. per share totalled over 99 per cent. Applications for additional shares amounted to over 35 times the number available. These have been allotted as follows:—Up to 15 shares, in full; 16 to 150, 15 shares; 151 to 2,000, 20 shares; 2,001 and upwards, 25 shares.

CHARLES WINN & COMPANY, LIMITED, valvemakers, etc., of Birmingham—The rights offer of 100,000 new 5s. ordinary shares at 5s. 3d. per share, which closed December 19, 1955, was taken up to the extent of 94,790 shares (£24,883). Applications for excess shares totalled 65,021 (£17,067). Allotment of the 5,210 shares available was made to ordinary holders on the following basis. Applications for up to 20 shares, in full; over 20 and up to 200 shares, 20 shares; thereafter one tenth of the amount applied for. No allotment was possible in respect of applications by preference holders.

MUREX, LIMITED—The board has declared an interim dividend of 7½ per cent., compared with 6 per cent. previously, on the £2,200,000 ordinary capital for the year ending April 30, 1956. This increase, the directors emphasize, is primarily a step towards equalizing interim and final dividends, and should not be taken as an indication of any increase in the total distribution. The overall level of activity at Rainham and Waltham Cross and trading results of the half-year to October 31, 1955, have shown a marked increase over the corresponding period of 1954 and so maintain the improvement achieved in the latter half of the last financial year, the directors state.

ATLAS STEEL FOUNDRY & ENGINEERING COMPANY, LIMITED—Mr. A. C. Strathie, chairman, reports that output for the year to September 30, 1955, fell by about 3½ per cent., but the net proceeds were considerably more, partly due to an increase in price but mainly to the nature of the work turned out. Orders fell off to a certain extent early in the year, but recovered later, and orders on hand at the end of September were satisfactory. Stocks on hand and work in progress both show increases. About 25 per cent. of available profits has been reserved and the dividend raised by 2d. per unit, making 1s. 9d. As indicated last year, no capital distribution is being made this year (2d., not subject to tax).

New Patents

(Copies of complete specifications are obtainable from the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s.)

741,362. Climax Molybdenum Company, 500 5th Avenue, New York, USA.

Improvements in or relating to processes for producing castings of molybdenum alloys. An amount of carbon necessary to establish a residual carbon content amounting from 0.01 to 0.25 per cent. by weight of the alloy is added. The metal and carbon mixture is melted together with not more than 15 per cent. by weight of the alloy of at least one of the ingredients listed, and the molten alloy is solidified. The amount of tungsten should not exceed the amount of molybdenum and the amount of any one of the following ingredients below should not exceed that stated: vanadium 7.0; titanium 14.0; tantalum 9.0; zirconium 2.0; columbium 10.0; nickel 0.4; iron 1.3; cobalt 0.9; and chromium 2.0 per cent. The various conditions under which these ingredients should be used are enumerated fully in the specification.

741,401. Gebr Bohler & Company, Aktiengesellschaft, Elisabethstrasse 14, Vienna, 1, Austria.

An improved continuous-casting plant, which is characterized by the fact that the lowering rolls are arranged just at the point where the temperature first becomes uniform throughout the entire cross-section of the billet.

741,601. Regie Nationale des Usines Renault, 8-10 Avenue Emile Zola, Billancourt, Seine, France.

A method of producing moulds for lost-wax precision casting. For the cylindrical frame of the mould a cylinder or metallic grating of heavily perforated sheet metal is used. It is rendered fluid tight by rolling a flexible waterproof sheet around it, tightness being obtained at the base by means of a suitable seal. After setting, the flexible sheet may be removed, the grating or perforated sheet remaining bound to the mould for subsequent operations.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

BATH, January 14—Cast-iron manhole covers and frames, road gully gratings and frames, coal cellar covers and frames, steel columns for street lighting, copper tubing and fittings, spun-iron pipes and special castings, valves and hydrants, cast-iron surface boxes, etc., for the year commencing April 1, 1956, for the City Council. The City and Waterworks Engineer, Guildhall, Bath.

BRIDGWATER, January 16—Cast-iron goods, for the period from April 1, 1956, to March 31, 1957, for the Borough Council. The Borough Engineer, Town Hall, Bridgwater.

LONDON, W.8, January 17—Heavy iron and mild steel for the 12 months commencing April 1, 1956, for the Royal Borough of Kensington. The Town Clerk's Office, Town Hall, Kensington, W.8.

TRURO, January 14—Cast-iron gully gratings, frames, and weirs, for the year ending March 31, 1957, for the County Council. The County Surveyor, County Hall, Truro.

WINCHESTER—Cast-iron manhole covers and gratings and cast-iron pipes, for the year ending March 31, 1957, for Hampshire County Council. Mr. A. C. Hughes, The Castle, Winchester.

SOUTH AFRICA, January 17—Brake drums and brake shoe machines, for the Stores Department of the South African Railways. (ESB/27300/55.)

A Yorkshire Die-casting Foundry

It is a good policy for a foundry to create a speciality which later becomes identified with a particular firm. By so doing, there is always a line of production that can be resorted to, if required, to take up the slack in a manufacturing programme. No matter how well planned, foundry programmes are always liable to suffer by the sudden withdrawal of an order, due to redesigning or other causes. The Yorkshire Die-Casting Company, Limited, Ashday Works, Elland, Yorkshire, produce thousands of castings daily for many industries—castings for such diverse articles as switchgear, washing machines, radiograms and machine tools. These castings are produced under strict supervision, followed by rigid inspection of every component. Some years ago, the British Standards Institution introduced a British Standards Certification Scheme, whereby licensees were authorized to use the "Kite" mark on their zinc-alloy die-castings, and this company have taken up this scheme and carry out the requirements with meticulous attention to detail.

A speciality evolved by this company is known as the "Parish drying plate," two stacks of which are illustrated (left) in Fig. 1. It is a device invented by the general manager, Mr. R. Parish, and a Patent has been applied for. Plates are used by the manufacturers of earthenware pipes, in place of the old-fashioned wooden drying-boards. The design is such as will ensure adequate circulation of air both inside and outside the pipe when drying. The castings incorporate four feet so that approach can be made from any side to lift a pipe with its stand (Fig. 1, right) by fork-lift truck, and thus eliminate manhandling. These plates are produced in various sizes to cover the full range of drain-pipe diameters. The largest plate (for 12-in. dia. pipes) at present in production is made in a nickel-cast-iron die, weighing about 8 cwt. and requires a two-man pouring operation.

Die Design

Another interesting casting made by this company is a 90-deg., aluminium-alloy shelf bracket. These castings are made in a composite gravity-die having six impressions. For two of the sizes made, the previous dies had a continuous life of about 14 years but difficulty had been found in the clearing of vents in the narrow impression forming the thin web on the inside of the bracket, often resulting in the breaking of the fine drills. When the new die was designed, it was decided that the block would be made in sections held together by tie rods. This made better venting possible by means of grooves 0.015-in. deep by 0.050-in. wide to which easy access was afforded. In the event of one impression requiring attention, the sections could be removed to the tool-room and temporarily replaced with a blank, permitting production in the die to continue but at a reduced rate.

Two further faults, also, were successfully overcome when redesigning. One was due to the fact that, previously, the top block, owing to its length and section, continued to warp slightly, causing unnecessary flash and necessitating periodic machining for correction. This component too, was made in a sectional manner, permitting each portion to bed to the die face and yet sliding away as one piece by means of "free" tie-bars. The third fault was that there was a tendency for movement of this block to carry into the impression minute particles of die coating, this being likely to affect metal flow and casting finish. The trouble was eliminated by making a slight rise in the runners of this block so that as soon as it had slid back a distance of $\frac{1}{4}$ in., it was lifted clear of the main die-block.

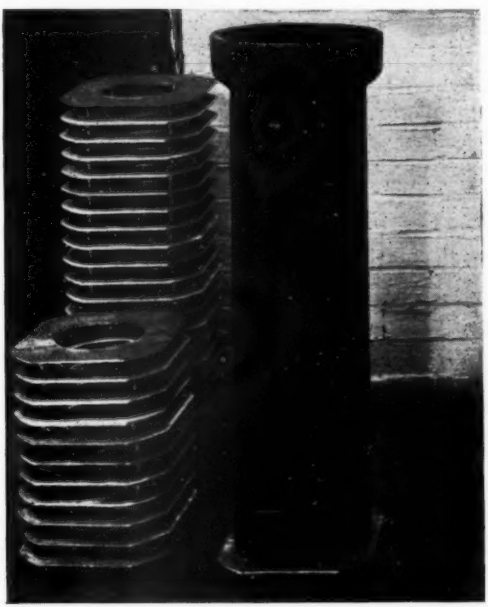
Planning

Whenever a casting or die is designed, the subsequent operations of trimming, etc., must be considered, and in the case of the bracket dies, great care was taken to ensure that every impression was identical, thus it was possible to produce a press tool having two impressions—one for each end of a bracket—in which the castings could be trimmed free of all flash, moving two castings along from left to right at each stroke of the press. Female labour is used throughout the trimming department of this company except for the setting up of jigs and fixtures, which is carried out by a skilled engineer.

The works have been established some 55 years,

(*Continued on page 22, foot of col. 2*)

FIG. 1 (*left*) *illustrates easy stacking of the Parish drying plate and* (*right*) *the drying plate under an earthenware drain pipe.*



Russian Pig-iron

According to the West German publication *Industrie-Kurier* of last December, "among the salient objectives of the next Soviet five-year plan the following figures for production in 1960 have been released:—52,000,000 tons of pig-iron and 59,000,000 tons of crude steel." While these figures have not yet been confirmed in the Soviet Press, they appear to replace the former planned figures of 50,000,000 tons of pig-iron and 60,000,000 tons of steel, which were still being quoted by Marshal Bulganin in July, 1955. The interesting aspect of the programme, if correct, is the relationship between pig-iron and steel. Recent ratios of crude steel pig-iron in USSR production have been as follow:—1940, 1.23; 1945, 1.38; 1950, 1.42; 1951, 1.43; 1952, 1.38; 1953, 1.40; 1954, 1.40; 1955, 1.3 (approximately) and 1960 plan, 1.13 (using figures quoted above). The United Kingdom proportion is roughly 1.57:1 and that of the USA 1.5:1.

While it is known that the USSR, with its rapidly expanding economy, is short of scrap and therefore requires a higher proportion of pig-iron for steel melting than the West, the new 1960 figures appear to be highly disproportionate. Is it possible, therefore, that the USSR is planning for a higher exportable surplus of pig-iron at the end of the next five-year period?

This would seem to be consistent with the data compiled by the UK steel delegation to the USSR, which commented on the low cost of pig-iron in the country. Since rolling-mill technology is not so far advanced as in the West, it would appear unlikely that the USSR could compete effectively in world markets for rolled products. The export of pig-iron is a more practical proposition. There is already a substantial export trade in Russian pig-iron and maybe the intention is to expand this trade in future.

Work-study and Materials Handling

The College of Production Technology, Charing, Ashford, Kent, have supplied for review a complete set of notes as used in connection with the courses on the above subject, which are being organized in most industrial towns. Whilst, obviously, it is possible to criticize some detail here and there, nobody could do other than postulate that the whole subject has been excellently covered. It is equally obvious that as production problems vary from works to works and shop to shop, any course can only stress basic principles and it is up to the student to apply those germane to any particular set of conditions.

When considering layout, foundries—both jobbing and mechanized—are dealt with. Whilst reduction in handling is the major theme, yet insurance costs must not be lost sight of, and therefore patternshop and stores are best housed in a separate building. In the reviewer's opinion the best system, where many patterns are being used, is to have a kiosk or office with the stores on one side and the patternshop on the other. At right angles to these would be the foundry and the despatch. By such an arrangement every pattern is routed: to patternshop for repairs—to the stores—to the foundry for production—or returned to the customer who has supplied it. This is an idea for the student to apply instead of slavishly following the explanatory diagram accompanying the text. Readers interested in taking these local courses should write to the London office of the College, 2nd Floor, Francis House, Francis Street, London, S.W.1, for details of time and place.

Future of Falls Foundry

Established as a textile engineering works, Falls Foundry, Belfast, previously belonging to Fairbairn Lawson Combe Barbour, Limited, will henceforth function in manufacturing machinery for the steel industry. The new owners will absorb the present labour force of about 400, and it is anticipated work will be sufficient for others. Information to this effect was given by Sir Peter Roberts, MP, chairman of the Wellman Smith Owen Engineering Company, the purchasing company, who—with his joint managing directors, Mr. F. H. Brookes and Mr. C. J. Barker—visited Belfast on December 16. They made a tour of the foundry and had discussions with Lord Glentoran, the Northern Ireland Minister of Commerce, and other high Government officials concerned. Sir Peter disclosed that they were planning a welding and fabricating section employing an additional 30 men. He had no fears whatever about the adaptability of the present Falls Foundry personnel, who were mainly textile engineers, considering that good engineers can turn their hands to anything so long as they know their machinery. He added, however, that the change would be extremely difficult from the managerial viewpoint. It was a question of taking over a factory which had run down and building it up again as quickly as possible in a new line of business. The Wellman group believed that the steel industry, not only in Great Britain but also in the world generally, was going to expand, and it was necessary that they as a company should be in the front of that expansion.

Export Credit Insurance

Addressing the Glasgow Chamber of Commerce, the comptroller-general of the Export Credits Guarantee Department, Mr. Rowland Owen, dealt with the suggestion that the Department should be more "venturesome" in the lengths of credit which it would insure. Mr. Owen stressed that ECGD's policy in the lengths of credit which it would cover was dictated purely by the interests of the export trade as a whole. If credit was extended to three months in one trade but not six, to seven years on another transaction but not ten, the reason was not "timidity." It was not an underwriting assessment at all: there was no set term of years beyond which a risk becomes so much increased as to make the department hold back and "play safe."

To cover any exporter on the terms he names might, however, be to encourage that individual to take business from other UK exporters at the price of upsetting the established terms in that particular trade. At the same time, were the department to assist in holding down terms offered from the UK to a point where overseas competitors offered longer credit and scooped the kitty in consequence, it would be acting against the interests of the export trade.

A Yorkshire Die-casting Foundry

(*Continued from page* 21)

and are kept thoroughly up-to-date by work planning, the use of scientific instruments, work flow and mechanization. Great attention is paid to inspection, starting from the receipt of the raw materials to the despatch of the finished components. It has been repeatedly proved that early planning—a feature of which are discussions between heads of departments, foremen and the technical manager— greatly assists in overcoming the many problems peculiar to the die-casting industry.

Centenary of "The Engineer"

The first issue of *The Engineer* was published on January 4, 1856. On January 4, 1956, exactly 100 years later, it celebrated 100 years of continuous weekly publication by the issue of a special centenary number to which 26 eminent engineers of this country contributed articles.

The Engineer seems to have been founded, to judge by early issues, largely with the idea of giving publicity to the spate of inventions that were being patented in the fifties of the last century. In 1858, for example, a leader dealing with the removal of the journal's offices to 163, Strand (where they remained for 33 years thereafter) refers to the job of the publication as "to teach the young idea to shoot so as not to miss the mark which should be aimed at, namely, the utilization of inventions." However, some years later the policy was changed for that of describing the actual products of engineering manufacture and of giving space to the publication of technical and theoretical articles contributed by notable engineers of the day. A selection of past contributors includes such varied people as Samuel Smiles, Professor Tyndall, Macquorn Rankine and Sir Oliver Lodge. The policy remains the same to this day.

Three Families

It has been the happy experience of many long-lived firms to flourish under the guidance of successive generations of a single family. What is remarkable and probably unique in the history of *The Engineer* is that three generations of each of three families have co-operated—in their own sphere—towards making the journal a success. Ownership and later chairmanship of the proprietary company has always lain in the Healey family; since 1865 the editor has always been a Pendred; and the Reveirs family has had a hand in printing the journal since the beginning.

The founder, Edward Charles Healey, was 33 years old when he started what turned out to be a very prosperous venture. In 1861 he took into partnership his elder brother Elkanah. When The Engineer, Limited, was incorporated in 1890, Edward's son, Charles, came into the partnership. In due course, following the death of Elkanah in 1893 and of Edward in 1906 (he had retired a few years earlier) control descended to Charles, who subsequently became Sir Charles Chadwyck-Healey, Bt., and who combined control of the journal with a distinguished career as a KC. Sir Charles died in 1919 and was succeeded as chairman by the late Sir Gerald Chadwyck-Healey, who died only a year ago. When in 1929 The Engineer, Limited, amalgamated with Morgan Brothers (Publishers), Limited, proprietors of the *Ironmonger* and the *Chemist and Druggist*, both founded in 1859, Sir Gerald became chairman of the new company. The present chairman, Oliver Chadwyck-Healey, succeeded his brother, Sir Gerald. A great-grandson of the founder, Charles Chadwyck-Healey, Sir Gerald's son, is assistant managing director.

When Edward Healey started *The Engineer*, in 1856, he chose as its "editor" a man whose name was Allen, but of whom nothing else, not even a christian name, is known. The point is probably significant. Very probably Allen never occupied a position even analogous to that of a modern editor. It was Edward, it can be hazarded, who really edited, as well as owned, the paper. Support is given to this view of the situation by the fact that when two years later Allen disappeared from the scene, Zerah Colburn, the next "editor," was appointed not specifically to the editorial chair but to "an influential position on the staff." Moreover, when, in 1860, Colburn, who, though brilliant intellectually and as a writer, was also eccentric and impulsive, went back to America, where he had been born, to start and to run for a few months a journal entitled *The American Engineer*, no successor was appointed. Edward, no doubt, carried on. In 1861 Colburn was back again, but his relationship with Edward Healey became difficult. Very possibly there were differences of opinion about his true position and function and, in 1864, he resigned. Two years later he became the first editor of *Engineering*, a rival and still flourishing journal. Competition has been keen ever since.

Editorial Continuity

It was at this stage that Edward Healey's choice of a new editor fell on Vaughan Pendred, a young Irishman who had come to England in 1862 and who had gained engineering experience with a small firm in Staffordshire. The appointment proved a wise one. For if Vaughan Pendred was less brilliant than Zerah Colburn he was less eccentric and less impulsive and he allied a good measure of native Irish wit to a sober fund of common sense. He retired in 1905, just a year before Edward Healey died and, as the latter had already retired, it was son, Sir Charles Chadwyck-Healey, who had to look about for a successor. Eligible for this post was Vaughan Pendred's son, Loughnan St. Lawrence Pendred, who had joined the firm in 1886 and had already made his mark. It fell to Loughnan Pendred to edit the paper in troublesome times. Despite two world wars and an inter-regnum of uneasy peace shadowed over by the general strike of 1926 and the great depression of the 'thirties, he raised the prestige of the journal to a high peak. In addition he served the profession of engineering with such distinction (amongst other honours he became president of the Institution of Mechanical Engineers) that in 1934 he was created CBE.

Again in the third generation Sir Gerald had to find, when the time came, in 1946, for Loughnan to retire, someone competent to take his place. History repeated itself. There was in the organization the present editor, Benjamin Pendred, who during the years of war had proved right-hand man to his father. Thus for 90 years the editor has been a Pendred.

Edward Healey, back in 1855, had entrusted the printing of *The Engineer* to Samuel Taylor, of Greystoke Place, off Fetter Lane. A member of the composing room staff (and soon to become manager) was a young man named George Reveirs. To him was given the job of composing the original prospectus heralding the advent of the journal. In 1874 he purchased the whole printing business and founded George Reveirs, Limited. To-day, though the firm recently became a unit in the Eden Fisher group, his grandson, George Leopold Reveirs, remains a director. For the greater part of a century, therefore, the fortunes of *The Engineer* have lain largely though not wholly in the hands of generations of these three families.

Top of Shipbuilding Returns

For the tenth successive year, Harland & Wolff, Limited, Belfast, is at the top of British shipbuilding output returns. In 1955 the company launched 14 merchant ships, aggregating 152,706 gross tons, and built engines totalling 153,480 i.h.p.

The year's tonnage was slightly below that of 1954. The company's Belfast shipyard launched 11 ships, totalling 121,687 tons, compared with 10 ships of 120,087 tons in the previous year, while three ships of 25,705 tons were launched at the Govan yard.

News in Brief

LANCASHIRE DYNAMO SWITCHGEAR, LIMITED, have removed from Bridgwater to new works at Hurst Green, Oxted, Surrey.

AS FROM January 1, Leyland Motors, Limited, are represented in Malaya by Wearne Bros., Limited, 45, Orchard Road, Singapore 9.

PLANS FOR SHOWERBATHS, costing £3,500, for steel workers of the Forth & Clyde Foundry at Kirkintilloch have been prepared and approved.

DAVY AND UNITED ROLL FOUNDRY, LIMITED, will shortly erect a new research building at Empire Works, Haverton Hill, Billingham-on-Tees.

TWENTY-TWO LOCOMOTIVES, formerly functioning on the Belfast and County Down railway, will be auctioned at a railway break-up sale this month.

FRY'S DIECASTINGS, LIMITED, Prince George's Road, Merton, London, S.W.19, is to have a new factory built on the Bede Trading Estate, South Shields, to employ 100 people.

AIR CONTROL INSTALLATIONS, LIMITED, Ruislip, Middx, announced that on January 2 they opened a sales office at 17, Manchester Street, W.1. Telephone: WELbeck 1306 (2 lines).

THE DIRECTORS of Peglers, Limited, brassfounders, Doncaster, have presented a cheque for £50 to each of five employees who have been with the company for 45 years, in recognition of their services.

FROM January 2 the address of Midland Ironfounders' Association was changed to 69, Harborne Road, Edgbaston, Birmingham, 15, and the secretary appointed at the executive meeting was Mr. L. H. Cleaver.

ACME CONVEYORS AND VENTILATING, LIMITED, held a successful Christmas dinner and dance at the George Hotel, Walsall, last month. Mr. Peter Lowe, sales director, presided in the absence of Mr. W. Tait, managing director.

FIELDEN ELECTRONICS, LIMITED, industrial instrumentation specialists of Wythenshawe, Manchester, have recently opened a Midlands office at 18, Wolverhampton Street, Dudley, Worcs. The engineer in charge is Mr. F. Bernard Price.

ON SHOW at the Birmingham Museum of Science and Industry, in a collection of early and historic machine tools, is a lathe used by Matthew Boulton at the Soho foundry and a 1760 lathe used in the manufacture of silver plate in Sheffield as late as 1944.

TWO THOUSAND EMPLOYEES with more than twelve months' service with Ley's Malleable Castings Company, Limited, and the Ewart Chainbelt Company, Limited, at Derby and Lincoln, have received £71,000 under the firm's profit-sharing scheme.

CASH AWARDS to 14 apprentices who had passed examinations were made on December 16 last at W. & T. Avery, Limited, Birmingham. The apprentices shared £85 and were presented with their awards by Mr. F. S. Eaton, works manager at Soho Foundry.

ERNEST FAIRBAIRN, LIMITED, Manfield House, 376-379, Strand, London, W.C.2, announce that from January 1 they will no longer act as agents for the Badische Maschinenfabrik A.G., but their foundry machines department will continue to operate.

S. WALKER & SONS (MANSFIELD), LIMITED, Station Foundry, Mansfield, Notts—a firm established in 1847, have produced a very colourful booklet which summarizes their activities as iron and brassfounders, wholesale builders' merchants and ironmongers.

THE BRITISH PRODUCTIVITY COUNCIL have recently produced a film called "Better Ways—The Whole Works" which illustrates the methods used by British Oxygen Engineering, Limited, in reorganization and relaying out their factory to give maximum efficiency and productivity.

WRIGHT BOAG AND HEAD WRIGHTSON (PTY) of Benoni are experimenting with the use of rammed tarred dolomite supplied by Cullinan Refractories, Limited, as a lining for their basic cupola. Initial runs have given promising results both as regards the life of the lining and the quality of the metal produced.

HILLS (WEST BROMWICH), LIMITED, have successfully completed a valuable contract worth £80,000 for the Australian Aluminium Production Commission. This was for supplying a complete natural ventilation system for Australia's newest industrial adventure—its first aluminium producing plant at Bell Bay, Tasmania.

E. & F. N. SPON, LIMITED, 15, Bedford Street, Strand, London, W.C.2, announce that by arrangement with the Institution of Production Engineers, they have become publishers and sole distributors of the book "The Automatic Factory: What Does it Mean." The reprinted edition will be available on January 20, price 30s.

A TRIP TO PARIS and a 10-day tour of a European country is offered by the European Productivity Agency to five winners in this country of a competition for an essay on productivity. Readers under 27 years of age who are interested should write to the British Productivity Council, 21, Tothill Street, London, S.W.1, for details.

THE NAME of Brush Bagnall Traction, Limited, a wholly owned subsidiary of the Brush Group, Limited, is being changed to Brush Traction, Limited. Mr. W. A. Smyth and Mr. E. W. Marten, directors of W. G. Bagnall, Limited, retire from the board of Brush Traction and Mr. J. Calderwood retires from the board of W. G. Bagnall.

MR. F. A. HURST, chairman of Samuel Osborn and Company, Limited, and president of Sheffield Chamber of Commerce, has presented awards and certificates to apprentices and members of the staff at the company's training centre in Penistone Road, Sheffield. Prize money distributed amounted to £45 10s., making the total gained in 1955 to £782 10s.

NOTTINGHAM UNIVERSITY has devised a scheme to meet the problem of the shortage of technologists, it was announced at the annual meeting of the court of governors. Boys and girls leaving school will join an industrial concern for a year's practical training, then go on to the university. After taking their degree they will return to the firm for another year.

JOHN HARPER & COMPANY, LIMITED, John Harper (Meehanite), Limited, Albion Works, Willenhall, and Poole Foundry, Poole, Dorset, distributed part of the profits amongst 1,446 employees as a Christmas bonus. The directors state that the allocation was due to increased output. Profit-sharing by employees was introduced as long ago as 1924 by the Willenhall firm.

THE BRITISH PRODUCTIVITY COUNCIL has produced three films on work-study, the first of a series which, when completed, will cover all aspects of the technique and its application, not only to industry, but to retailing and distribution, office work and farming as well. Those wishing to buy copies of the films should apply to the British Productivity Council, 21, Tothill Street, London, S.W.1.

NORTHERN ALUMINIUM COMPANY, LIMITED, opened a new sales office at 16, Cumberland Place, Southampton,

Hants, in December last, and are to open another at 57, Bute Street, Luton, Beds, on January 16. These are regional offices, serving territories that are part of the company's main London sales area. Their Manchester-area sales office has now moved to larger premises at 23, Princess Street, Manchester, 2.

AN AGREEMENT has just been signed between Leyland Motors, Limited, of Lancashire, and the Netherlands company of Van Doorne's Automobielfabriek N.V., of Eindhoven, builders of D.A.F. vehicles and trailers. Under this, Van Doorne's will have the right to manufacture Leyland diesel engines of various sizes in horizontal and vertical forms, as well as the Albion four-cylinder horizontal and vertical 60-h.p. unit.

SOME 300 PEOPLE who attended the works dinner of C. & W. Walker, Limited, saw the chairman and managing director, Mr. S. M. Milbourne, present awards to three workmen who had completed 50 years' service in the Midland ironworks at Donnington. The recipients were Mr. Bert Leese, foreman, steel department, Mr. Jim Toddington, planning department, and Mr. Sam Lloyd, foundry. Two others, who were unable to attend, will receive awards later. Each man received a suitably inscribed barometer.

NEW HEADQUARTERS have been found at Acock's Green, Birmingham, for the Birmingham Industrial Group's training centre, which is under notice to quit its present Corporation-owned premises at the Birmingham Museum of Science and Industry. The purchase price is £3,000, and Midland industry has promised to assist in raising the funds necessary for the establishment of the centre. Mr. C. D. Lovell, factory manager of Alfred Bird & Sons, is succeeding Mr. Yapp as chairman of the Group.

CALLENDAR IRON WORKS, Falkirk, held its first reunion of retired and present employees at Christmas week-end. Mr. G. McLeod, works manager, presided at high tea and extended a welcome to all present. A programme of entertainment followed. Mr. R. G. Sinclair, managing director, presented the retired workers with the annual gift from the works benevolent fund together with a personal gift from himself. Among the former employees present was 75-year-old Mr. Alex. McLuckie, who had been with the firm for 60 years.

S. RUSSELL & SONS, LIMITED, of Leicester, was started as a brass foundry in 1864 by the grandfather of the present chairman of directors, Mr. S. H. Russell. It was not until about 20 years later that the firm took up iron-founding, but the position has now arisen whereby the development of the firm's specialized products, particularly spheroidal-graphite iron, is such that it has been decided that the non-ferrous section of the foundry should be closed down from December 31, 1955, and the available space used to increase iron-castings production.

THE PART APPRENTICES HAD TO PLAY in the future of the industrial prosperity of the country was emphasized by Alderman A. G. B. Owen, chairman and joint managing director of the Rubery Owen organization when he presided at the prize distribution on December 22. Mrs. F. L. Owen, and other members of the family presented 287 prizes worth more than £1,600. The P. J. Freeman Memorial prize and the J. T. Page prize for the best all round apprentices were awarded to Mr. Alan J. Bayley and Mr. Robert Mott, respectively.

UNDER THE AUSPICES of the metallurgical engineering committee of the Institute of Metals, an all-day informal discussion on "Furnace Refractories for the Use of the Non-ferrous Metal Industries," will be held at the University, Edgbaston, Birmingham, on February 24, at 10.30 a.m. Visitors, for whom no tickets are required, will be welcome. Members and visitors may take luncheon (price 6s.) in the University Refectory, provided that they give notice to the secretary of the Institute, 4, Grosvenor Gardens, London, S.W.1, not later than February 16.

RANSOMES & RAPIER, LIMITED, have received another order for a RapieR W 1400 "walking dragline" from Stewarts and Lloyds, Limited. This repeat order follows four years' working experience with the original W 1400, which strips overburden up to 100 ft. deep from the ironstone beds at Corby, Northants. Claimed to be the largest working dragline in the world, the Rapier W 1400 weighs 1,650 tons, carries a 20-cub. yd. dragline bucket on a 282-ft. long boom, and is powered by two 1,500-h.p. motor generator sets running on 6,000-v. supply. It is of all-British design and construction.

SENIOR EXECUTIVES of the American Brake Shoe Company are to visit the Wednesbury steel works of F. H. Lloyd & Company, Limited, James Bridge, this month, to discuss the formation of a new enterprise for the production of precision ferrous castings to serve the growing demand for jet-aircraft castings and tyre moulds. The principal item for discussion, it is understood, will be the choice of a site "for a fairly large building." Mr. Michael Lloyd, a director of the firm, emphasized that the project was in no way a merger but an agreement for the formation of a new company with holdings on both sides.

TWELVE EMPLOYEES of the Parkinson Stove Company & Monitor Engineering and Oil Appliances, Limited, of Stechford, Birmingham, with a total of 547 years' service, received presentations last month. Two of them, Mr. T. Williams, with 51 years' service, and Mr. M. Poole, with 50 years, each received gifts valued at £50; the remaining ten received gifts worth £25. All twelve employees belong to the Parkinson and Cowan group Long Service Association, whose members have all given at least 21 years' continuous service. It is the practice to give each member a sum of money on retirement based on length of service, but these presentations, made by Mr. R. J. Rogers (chairman of the Parkinson Stove Company), were supplementary ones granted by the parent board of directors.

A TWO-YEAR £10,000 research programme into factory building and operating problems, intended to prepare the way for greater standardization, lower building and maintenance costs and to reduce factory building delays, is to be sponsored by the Midland Regional Board for Industry. It is believed to be the first time that such a pioneering and constructive enquiry has been sponsored by a regional board. The investigation, which is being financed by professional and trade associations, local authorities and several companies, will be undertaken by the Building Research Station of the Department of Scientific and Industrial Research at Princes Risborough. Trustees are to be appointed to administer the funds and to recruit technical staff for the project which is expected to begin early in 1956. The first interim report is expected in six months and the full results in two years' time. The findings will be freely available to all firms, and it is thought that the definition of some standardization of factory design and building may be of national importance. The project is of particular interest in the Birmingham area where many firms are faced with costly rebuilding programmes consequent on the city's redevelopment scheme.

Forthcoming Events

JANUARY 9

Institute of British Foundrymen

Sheffield and district branch:—"Dust Control in Foundries," by C. M. Stoch, 7.15 p.m., at the Sheffield College of Commerce and Technology, Department of Engineering, Pond Street, Sheffield, 1.

Lancashire branch:—"Practical Simple Casting in the Foundry," by G. B. Judd, B.A., 7 p.m., at the Midland Hotel, Manchester.

Institution of Production Engineers

Sheffield section:—"Health in Industry," by Dr. P. R. Hartley, M.B.E., 6.30 p.m., at the Grand Hotel.

JANUARY 10

Institution of Works Managers

Birmingham branch:—"Management as Seen from the Shop-floor," by L. Pridmore, 7 p.m., at the Birmingham Exchange and Engineering Centre, Stephenson Place.

Sheffield branch:—"Problems of a Solicitor," by A. L. Sacken, 7.30 p.m., at the Grand Hotel.

Incorporated Plant Engineers

Edinburgh branch:—"Materials Handling," by J. Findlay, 7 p.m., at 25, Charlotte Square.

Institution of Mechanical Engineers

Yorkshire branch, graduates section:—"Engineering Maintenance," by W. G. Kirkwood, 6.30 p.m., at the Engineering Lecture Theatre, University of Sheffield.

Institution of Production Engineers

Coventry section:—"Production of Piston Rings," by H. C. Blackford, 7 p.m., at the Craven Arms, High Street.

London graduate section:—Works visit to Enfield Rolling Mills, Limited, Brimsdown, Middlesex.

JANUARY 11

Institute of Industrial Supervisors

Warrington section:—"Money in Industry—Where Does it Come From—Where Does it Go To?" by T. Price, 7.30 p.m., at the White Hart Hotel.

Institution of Production Engineers

Liverpool section:—"Die Casting," 7.30 p.m., at the Exchange Hotel.

Institute of Vitreous Enamellers

Southern section:—"New Fields of Application for Vitreous Enamellers," by J. H. Gray and T. G. MacArthur, 7.30 p.m., at the Howard Hotel, Norfolk Street, Strand, London, W.C.2.

JANUARY 12

Institute of British Foundrymen

Lincolnshire branch:—"Foundry Developments," by D. Killingworth, 7.15 p.m., at the Technical College, Lincoln.

Burnley section:—"Some Aspects of Foundry Techniques," by H. Haynes, 7.30 p.m., at the Burnley Technical College, Ormerod Road.

Southampton section:—Technical films, 7.30 p.m., at the Technical College, St. Mary's Street.

Beds/Herts section:—"Propeller Manufacture," by J. M. Langham, M.A., 7.30 p.m., at W. H. Allen, Sons & Company, Limited, Bedford.

Incorporated Plant Engineers

Glasgow branch:—"Some Factors Concerning Works Capital Expenditure," by F. Franklin, Babcock & Wilcox, Limited, 7 p.m., at Scottish Building Centre, 425/427, Sauchiehall Street.

Liverpool Metallurgical Society

Discussion on "Modern Techniques of Metallurgical Analysis," 7 p.m., at the Liverpool Engineering Society, 9, The Temple, Dale Street.

Incorporated Plant Engineers

Merseyside and North Wales branch:—"Radiography in Industry," by E. J. Grimwade, A.R.P.S., 7.15 p.m., at the Royal Institution, Colquitt Street, Liverpool.

JANUARY 13

Institute of British Foundrymen

Tees-side branch:—"Pattern Equipment — Present-day Trends and the Future of the Patternmaking Craftsmen," by L. Brown, 7.30 p.m., in the Teesdale Hall, Head, Wrightson & Company, Limited, Thornaby-on-Tees.

JANUARY 14

Institute of British Foundrymen

Newcastle and district branch:—"Some Foundry Techniques," by C. R. Van der Ben and H. Haynes, 6 p.m., in the Neville Hall, Westgate Road, Newcastle-upon-Tyne.

Scottish branch:—"Jobbing Production of Light Alloy Castings," by A. S. H. Sawers, 3 p.m., at the Royal Technical College, George Street, Glasgow.

Bristol and West of England branch:—"Modern Cupola Practice," by W. H. Bamford, 3 p.m., at the Grand Hotel, Bristol.

Board Changes

MIDLAND TAR DISTILLERS, LIMITED—Mr. M. Macintosh Williams has resigned from the board.

INGERSOLL-RAND COMPANY, LIMITED—Mr. L. R. Hewitt, general sales manager, has been appointed a director.

SIEMENS BROS. & COMPANY, LIMITED—Lord Killearn and Major-General C. W. Fladgate have resigned their directorships.

LITHGOWS, LIMITED—Mr. James Lenaghan has been appointed a director. Mr. James Wylie has resigned from the board.

RUSTON-BUCYRUS, LIMITED—Mr. F. T. Hartland has been appointed to the board. He will continue to act as secretary.

R. J. H. TOOL & EQUIPMENT COMPANY, LIMITED—Mr. J. Rhodes, the general manager, has been elected a director of the company.

INDIAN IRON & STEEL COMPANY, LIMITED—Sir Biren Mookerjee has been elected to the board in place of Mr. F. G. Liversedge, who has resigned.

POWELL DUFFRYN, LIMITED—Mr. Keith Augustine Hogan, Mr. William Herbert Sharland, and Mr. Douglas George Badham have been appointed directors.

RICHARDSONS WESTGARTH & COMPANY, LIMITED—Mr. W. R. Jones, managing director of the subsidiary, George Clark & North Eastern Marine (Sunderland), Limited, has been appointed a director.

WHARTON CRANE & HOIST COMPANY, LIMITED—Mr. Harry Wharton assumed the presidency of the company on January 1 and has been succeeded as chairman and managing director by Mr. Harold Smith.

Increases in Capital

STOURBRIDGE ENGINEERS & IRONFOUNDERS, LIMITED, increased by £15,000, in £1 ordinary shares, beyond the registered capital of £25,000.

ASQUITH MACHINE TOOL CORPORATION, LIMITED, increased by £150,000, in 5s. ordinary shares, beyond the registered capital of £900,000.

JOHN SHAW & SONS (SALFORD), LIMITED, general engineers, etc., increased by £75,000, in £1 ordinary shares, beyond the registered capital of £90,000.

SMITH & MORGAN (WEST BROMWICH), LIMITED, brassfounders, engineers, etc., increased by £10,000, in £1 ordinary shares, beyond the registered capital of £5,000.

SAMUEL SMITH & SONS, LIMITED, ironfounders, etc., of Smethwick (Staffs), increased by £35,000, in 2s. ordinary shares, beyond the registered capital of £15,000.

WILLIAM COOK & SONS (SHEFFIELD), LIMITED, makers of steel castings, etc., increased by £70,000, in 4s. ordinary shares, beyond the registered capital of £10,000.

HAMWORTHY ENGINEERING, LIMITED, Poole (Dorset), increased by £50,000, in £1 7 per cent. cumulative redeemable preference shares, beyond the registered capital of £250,000.

Recent Wills

DUDLEY, THOMAS, retired ironfounder, of Tipton (Staffs) £41,047

CRUSE, H. A., a director and former general works manager of the Westinghouse Brake & Signal Company, Limited £14,189

BUSH, F. C., chairman of the Castle Engineering Company, Limited, Nottingham, and a former director and general manager of the Raleigh Cycle Company, Limited £31,083

CAMERON, JAMES, who was for 35 years secretary of the North-East Coast Engineering Employers' Association, the Tyne Shipbuilders' Association, and the North-East Coast Shiprepairers' Association ... £15,895

Personal

Mr. D. L. CAMPBELL has been appointed director of the Metallurgical Export Company, Limited.

Mr. F. B. HOWARD-WHITE has been appointed a director of the Mond Nickel Company, Limited.

Mr. A. W. BELL, a director of H. Bell (Machine Tools), Limited, Leeds, has been elected vice-president of the British Association of Machine Tool Merchants.

Bakelite, Limited, announce that Mr. R. HART STILL has been appointed to the board of directors, and that Mr. A. J. HEARN has been appointed chief accountant.

Samuel Fox and Company, Limited, announce that Mr. C. M. SLOCOMBE has been elected to the board of directors of the company, with effect from January 1.

Mr. M. NELSON retired last December from the position of technical representative with Websters (branch of Pickford, Holland & Company, Limited) of Sheffield.

MISS BETTY BELSON, secretary of the Midland Regional Board for Industry, is resigning the post to take an appointment in the regional office at the Board of Trade at Reading.

Mr. M. STEVEN DICK, managing director of A. & P. Steven, Limited, engineers, Glasgow, has been elected president of the Scottish Engineering Employers' Association for the ensuing year.

Mond Nickel Company, Limited, announce that Mr. EDWIN R. PERRY, D.F.C., A.I.M., has been appointed as a development officer in the platinum metals division of the development and research department at Acton.

SIR PERCY MILLS, BART., K.B.E., is the new chairman of the Lancashire Dynamo Group. MR. STANLEY STEWARD, C.B.E., has been appointed managing director. MR. H. W. BOSWORTH has retired after fifty years' service as chairman and managing director.

Mr. ROBERT CARR, M.P., has, owing to his appointment as Parliamentary Secretary to the Ministry of Labour and National Service, resigned all his directorships, including that of John Dale, Limited, of which he was deputy chairman.

Mr. W. R. JONES, managing director of George Clark, Limited, and the North Eastern Marine Engineering Company, Limited, has been appointed a director of the parent company, Richardsons Westgarth & Company, Limited, with effect from December 14, 1955.

W. T. Henley's Telegraph Works Company, Limited, London, E.C.1, announce that Mr. FRANK G. WILMOT has been appointed director and secretary of Oakley Brothers, Limited, Cradley Heath, Staffs. He became secretary of Oakley Brothers in 1945, when that concern was acquired by Henley's.

Mr. FRANK BROCKHOUSE, last month, received a pair of electric candelabra in antique silver from his colleagues on the board on the occasion of his retirement from the firm of J. Brockhouse & Company, Limited, West Bromwich. Mr. J. L. Brockhouse, chairman and managing director, made the presentation.

Mr. A. R. WIZARD, previously assistant manager at the art foundry of the Morris Singer Company, Limited, has been appointed general manager of the company. He has also been made a director of Sundry Equipment Manufacturers, Limited, of which he was previously general manager; this firm is associated with Morris Singer's.

The Minister of Fuel and Power has appointed as part-time members of the National Coal Board Mr. S. P. CHAMBERS, Mr. J. CRAWFORD, Mr. W. L. HEYWOOD, and Sir HENRY WILSON SMITH, for three years as from January 1, to replace LORD HEYWORTH and Mr. J. H. HAMBRO, who resigned last February, and Mr. GAVIN MARTIN and Alderman WILLIAM BAYLISS, whose appointments ended at the new year.

Mr. ERNEST ROBINSON, assistant secretary, has been appointed secretary of Thos. W. Ward, Limited, Albion Works, Sheffield, and Forward Tension Securities in succession to the late Mr. H. Beresford. Mr. E. M. DODD, financial advisor to the board of Thos. W. Ward, will take up the newly created position of group chief accountant, covering the accounts of the parent company and all subsidiary companies comprising the Ward group.

Two foremen with a combined service of 100 years with the Kilmarnock locomotive engineering firm of Andrew Barclay, Sons & Company, Limited, recently received retirement presentations. They were Mr. ROBERT M. HAYWOOD, foreman brass finisher, who served his apprenticeship with the firm and has a total service of 57 years, and Mr. JAMES BRECKENRIDGE foreman iron moulder, with 43 years' service. Mr. THOMAS MCCALL, of the smithy department, who retired after 51 years' service, also received a presentation.

Obituary

MRS. MARY SOPHIA WARD, widow of Mr. T. W. Ward, the founder of Thos. W. Ward, Limited, Albion Works, Sheffield, died on December 26 last at the age of 92. She was Mistress Cutler in 1914.

THE DEATH is announced of Mr. A. E. MCRAE SMITH, M.A., director of Kingsley Laboratories, Limited. He came into prominence as a metallurgist when he was foundry manager at the works of J. and E. Hall, Limited. His next position was as metallurgist attached to the Research and Development Department of the Mond Nickel Company, Limited. Mr. Smith joined the London branch of the Institute of British Foundrymen in 1938 and was awarded the Institute's Diploma for a paper to that branch on pressure-tight castings.

The sudden death last month of Mr. JAMES COSSEY, head of the technical sales department of Borax Consolidated, Limited, is announced. Born in Ormsby St. Michael in 1913, he took his degree in chemistry from the Royal College of Science, 1932/35, and obtained the D.I.C. in agricultural chemistry. He served in the RAF during the war, and resumed his engagement with Borax Consolidated, Limited, in 1946. In recent years he visited various overseas markets and had acquired a very specialized knowledge of the borax industry.

The death occurred last month, at the age of 71, of Mr. GEORGE LEVY, vice-chairman since 1928 of George Cohen, Sons & Company, Limited, the parent concern of the "600" Group of Companies. For many years he played a very active part in the development and administration of the George Cohen organization. Only recently he resigned his chairmanship of K & L Steelfounders & Engineers, Limited, of Letchworth—a company acquired by the "600" Group in 1928. It was largely due to his courage and brilliant business ability that this firm was able to weather the economic storms of the great depression in 1929/32, and so, in the course of years, to attain its present industrial eminence as one of the biggest manufacturers of steel castings and mobile cranes in Great Britain.

Raw Material Markets

Iron and Steel

During the Christmas and New Year holidays essential repairs and renewals to plant were carried out, so that, subject to unforeseen mishaps, uninterrupted production can proceed in the months ahead.

The new year brings very little change in trading conditions. The engineering and speciality foundries were heavily engaged throughout 1955 in the production of high-duty castings for many trades on both home and export account, and order-books are maintained at high levels. Their chief concern has been to secure adequate supplies of pig-iron to fulfil their commitments and this position persists.

The supply of the low- and medium-phosphorus irons, which are preferred by most of the engineering foundries, remains stringent, and although there are now prospects of some improvement in deliveries, it is not expected to amount to a great deal until an additional supply beyond the present sources is established.

Hematite deliveries last year were on a varying scale. The position has improved, although not to such an extent as to satisfy fully present demands, and consumers are finding it almost impossible to obtain the higher silicon irons of 3 per cent. and over, of which many are in need.

Judging by the present needs of the engineering and speciality foundries, any increase in outputs of the grades of pig-iron they use could be fully and readily absorbed for some time ahead.

There is a marked difference in the position at the light foundries, where trade is slow and productive capacity is such as to require a much greater flow of business than is at present forthcoming; this position applies also to many of the textile foundries. A number of the light foundries cater for trades affected by the credit squeeze and are short of work; some are on short time. Most of the jobbing foundries are busy, and while they and some of the engineering foundries are taking up fair tonnages of high-phosphorus pig-iron, there appears at present to be an excess in production of this grade over the demand.

The demand for good quality scrap persists. Coke deliveries are in line with current needs, and ganister limestone and firebricks can be obtained as required.

Non-ferrous Metals

The increase in the price of lead in the United States by ¼ cent a pound to 16 cents was not unexpected. The London Metal Exchange price is still climbing to record heights for free dealings and yesterday (Wednesday) topped £126 for current metal. Demand is unusually strong in the US for this time of year; the supply position is tight and some producers have a waiting list of consumers.

Demand for zinc is also strong and with the price in London yesterday topping £105—a new free-trading peak—the US quotation is expected to be raised shortly. Indeed, trade circles in both London and New York fully expected the rise to follow that of lead, but the supply position in zinc is not so difficult and the US is not so dependent on imports of zinc as it is of lead. Yet there are few sellers of large quantities of zinc on a flat price basis of 13 cents and there is little inclination to sell any quantity beyond this month.

The UK price of Canadian primary aluminium (1-20K ingot of 99.5 per cent. purity, delivered to consumers) was raised by £8 per long ton to £179 on January 1. Premiums applicable for higher purities and different forms remain unchanged. This is the first increase since last July, when the price was also advanced by £8 per ton, and represents a rise in Canadian production costs, brought about largely by the recent droughts which have resulted in cutting back output by 10 per cent.

The tin market has ruled steady in London and New York. Demand is good and the bright outlook remains unaltered. Stocks of refined tin in LME official warehouses fell by 134 tons to 616 tons during the week ended December 31. UK tinplate prices have been raised by 2d. per basis box as a result of the higher average prices for tin over the last three months.

The copper market is something of a puzzle following the continuation of the strike by the Chilean mineworkers. At the slightest evidence of offerings to the market the price in London has been dropping. In New York, however, copper is quiet, although the undertone is firm.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* December 29, £396 to £396 10s.; December 30, £399 10s. to £400; January 2, £396 to £398; January 3, £398 to £399; January 4, £394 10s. to £395.

Three Months: December 29, £390 to £391; December 30, £393 10s. to £394; January 2, £389 to £390; January 3, £390 10s. to £391 10s.; January 4, £386 10s. to £387.

TIN, Standard—*Cash:* December 29, £830 to £831; December 30, £831 10s. to £832; January 2, £832 10s. to £833; January 3, £848 to £850; January 4, £844 to £845.

Three Months: December 29, £809 10s. to £810; December 30, £812 10s. to £813; January 2, £814 to £815; January 3, £821 to £822; January 4, £820 to £821.

LEAD—*Second half December:* December 29, £116 15s. to £117; December 30, £120 to £120 10s. *First half January:* January 2, £120 to £120 10s.; January 3, £122 to £122 5s.; January 4, £126 5s. to £126 10s.

Second half March: December 29, £116 to £116 5s.; December 30, £118 5s. to £118 10s. *First half April:* January 2, £118 10s. to £119; January 3, £119 5s. to £120; January 4, £123 5s. to £123 10s.

ZINC—*Second half December:* December 29, £99 15s. to £100; December 30, £101 to £101 10s. *First half January:* January 2, £101 10s. to £101 15s.; January 3, £103 to £103 10s.; January 4, £105 to £105 5s.

Second half March: December 29, £97 to £97 5s.; December 30, £98 10s. to £98 15s. *First half April:* January 2, £98 15s. to £99; January 3, £100 to £100 10s.; January 4, £101 15s. to £102.

Pourer without Goggles—Firm Fined

At Holmfirth recently, a fine of £5 was imposed on the firm of J. and J. W. Longbottom, Limited, ironfounders, Bridge Foundries, Holmfirth, for failing to provide suitable eye protection for a workman who was splashed in the eye by molten metal. It was stated by Mr. J. B. H. Morton, inspector of factories, that a labourer, Dennis King, was engaged with five other men pouring metal into a mould when some was blown back and struck him in the eye and burned his clothes. The firm pleaded "not guilty." Mrs. M. Firth, managing director, said that goggles were available if King had asked for them, but most of the men refused to wear them because they steamed up. Although a new type of goggles had since been issued, Mrs. Firth said she had seen only three or four men wearing them.